THE AMERICAN GAS-LIGHT JOURNAL AND CHEMICAL REPERTORY

Publishing Office, No. 42 Pine Street.

DEVOTED TO THE INTERESTS OF ILLUMINATION, VENTILATION, WATER SUPPLY AND DISTRIBUTION, & GENERAL SCIENCE.

VOLUME XXV.—No. 2. Whole No. 410 | NEW YORK, MONDAY, JULY 17, 1876. | $3 PER ANNUM IN ADVANCE

A. M. CALLENDER & CO., Proprietors.

G. WARREN DRESSER, Editor,

CONTENTS.

☞ An asterisk (*) denotes an illustrated article

EDITORIAL—

Gas Making in Paris 43
The British Association of Gas Managers 44
The Stevens Institute of Technology 44
Heat Units in Gas Burning 44
Mr. Young on Condensation 45
The Beckton Gas Works 44
Uniform Weight of Coins 45
West of Scotland Association of Gas Managers 46
Amount of Heat Resulting from Combustion of Illuminating Gas 47
Dr. Wurtz's Great Chemical Discovery 48
Health of Workmen in Gas Works 48
Report on the Development of the Chemical Arts During the last Ten Years 49
Physical Society 49
Liernur's Pneumatic Sewerage 50
Imperfect Drainage 50
Gas-Light Intelligence 50
Chemical and Scientific Repertory 50
Hardening and Tempering Glass 51
Division of an Acid Among Several Bases 51
Franklin Institute Reception Room at the Centennial 51
The Meeting of the Mining Engineers 52
Engineering History of this Country 52
Sanitary Carbon 52

WISHING TO MAKE THIS JOURNAL an organ of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, the publishers solicit letters from all among them who make the study of these subjects a pleasure, or a profession.

Subscribers would confer a favor upon us by remitting *CHECKS*, or *POST OFFICE MONEY ORDERS*, as we are frequent losers where money is enclosed in letters.

The price of this Journal is, in advance, **$3.00 per Annum. Single Copies Fifteen Cents.**

☞ NEWS AGENCY.—The American News Company, 119 and 121 Nassau street, New York agents for this Journal. News dealers will please send orders to them.

☞ All communications to be addressed to **"The Proprietors,"** No. 42 Pine Street, Room 18, New York.

TO OUR SUBSCRIBERS AND PATRONS.

In making remittances for subscriptions, always procure a draft on New York, or a POST OFFICE MONEY ORDER, if possible. Where neither of these can be procured, send the money, but always in a REGISTERED LETTER. The registration fee has been reduced to eight cents, and the registration system has been found by the postal authorities to be actually an absolute protection against losses by mail. ALL Postmasters are obliged to register letters whenever requested to do so.

NOTICE.

☞ *All Collections for Advertisements, Subscriptions, etc., are made directly from this Office. We have Agents to solicit the same, but they are not authorized to Receipt for Money.*

GAS MAKING INPARIS.

In these times of depression in the gas business it is quite refreshing to find that in some places, even though it be in Europe, the business is increasing. In the report of the Paris Gas Light Company, which is just published, there is much valuable information, and the point to which we wish to draw particular attention is that, taking the operations of a series of years there will be found certain years, when not only no increase occurs but a falling off, in the consumption. These results are due to the condition of affairs in general, and are exceptional, but still the general result is always the same, viz: At the end of the term of years there is a large increase. No man can to-day estimate what will be the increase of gas manufacture in this country during the next 25 years and if one was to venture the opinion that it would amount to 330 per cent. he would doubtless be considered *very* visionary. Still this is the actual rate of increase in Paris in the last twenty years. During the year 1875 there was sent out from the ten stations of the Paris Co. 6,211 million cubic feet.

The day consumption was 1,171 million cubic feet. In this item there has been an increase of nearly 100 millions during the past year, which is largely due to the successful and economical application of gas to many mechanical and domestic purposes. Here is a point worthy of the earnest consideration of our gas managers. If the distribution plant could be as fully occupied in the day as at night, the cost of gas to the consumer might be largely reduced, and the profits of the Company not diminished. The number of public lamps is 39,407. The number of consumers Dec. 31, 1875, was 111,221, being an increase of 6,542 during the year; of this latter number 4,230, or nearly *two thirds* are supplied by "Conduit's Montauts," which are pipes carried from the bottom to the top of buildings for the supply of flats and separate apartments. During the year the Company put in 1,395 of these at cost of about $100 each. The number of consumers using gas in this way is about one-fifth of the whole number and the receipts therefrom are nearly one-tenth of the total. The total length of main is about 1,000 miles. But the point where this Company seem to be very far in advance of any thing in this country is in its Residual products.

We give from the London *Journal* the close of the report, and we urge upon our gas makers the question how long before they can make the statement at the end thereof, viz: "We are now able to affirm that the whole of the coal received into our works leaves them in the shape of merchantable products *without loss or waste.* "We quote—

LABOUR, MATERIALS, RESIDUALS, &C.

"*Labour.*—During the year 1875 there was but a very slight increase in the number of workmen at the several stations of the company, and we have invariably had to congratulate ourselves on the amount of work performed by our staff of operatives, and the good will they have evinced towards us.

"*Coal.*—For the past twelve months the price of coal has varied but little; nevertheless we have been able to renew, on relatively advantageous terms, those of our contracts which were drawing to a close. We need scarcely tell you with what attention we follow the market price of a raw mateial which forms so important an item in our working expenses.

"*Coke.*—The employment of coke for domestic purposes continues to become more general, notwithstanding the extent to which, for some time past, heating by gas has been adopted. Although in 1875 we produced 980,140 hectolitres (2,695,385 bushels) more than in the preceding year, the stock on hand on the 31st of December last exceeded by 28,384 hectolitres (78,056 bushels) only the quantity in store at the same date in 1874. As we remarked in our last report, these two modes of heating, by gas and by coke, appear to be attaining perfection without clashing one with the other.

"The produce from the sale of coke, which in 1874 amounted to 12,744,854 frs. reached the sum of 14,098,434 frs. 1875. The amount produced by the sale of metallurgic coke was 678,812 frs., exceeding by 102,892 frs., the sum received for this product in the preceding year. The receipts for coke alone were therefore increased by more than 1,450,000 frs. (£58,000.)

"*Heating Apparatus.*—The number of apparatus for heating by coke that were sold during 1875 reached 2,633, bringing the total number of these apparatus which have left the company's works up to the present time and are now in action in Paris to 40,731. These apparatus, which we sell at the lowest possible price, are constructed with particular care, and they have greatly contributed to ensure the sale of our coke.

"*Tar and Chemical Products.*—All the products resulting from the treatment of our tar and ammoniacal liquor are in greater request, and enjoy upon the market a reputation which renders their disposal easy and advantageous.

"During the year 1875 we received for tar

2,501,664 frs., chemical products, 844,956 frs.; making a total of 3,346,620 frs., (£133,865). These figures are higher than those for the preceeding years, which were as follows:—For 1872, 1,657,843 frs.; for 1873, 2,230,113 frs.; for 1874, 2,638,858 frs. This increase in 1875 is especially due to the extension that has been given to the manufacture of a new product known as *anthracene*—an article used in the manufacture of artificial alizarine.

"*Gas-Engines.*—The development of this portion of the company's operations has not progressed so rapidly as we had hoped. In the course of the past year, however, we sold nine horizontal engines on Lenoir's system, and 35 vertical engines on that of Otto and Langen, representing altogether a motive force equal to 48½-horse power. The engines on the latter system, which, unlike those on Lenoir's plan, do not require the use of electricity, seem destined to be rather extensively employed. The number of gas-engines in use in Paris on the 31st of December last was 201, the quantity of gas consumed by which may be pretty closely estimated at 707,500 cubic metres, or about 25 million cubic feet.

"*Compressed Fuel.*—In our most recent reports we informed you that, having been unable to find a sale for considerable quantities of breeze, with which all our stations were encumbered, we had decided upon converting this residual, by means of compression, into a combustible fuel, to be used in place of coke for heating the boilers and ovens.

"During the year 1875 we manufactured 15,444 tons of compressed fuel, the employment of which upon our works enabled us to offer for sale, instead of using it for heating the ovens, about 380,000 hectolitres (1,045,000 bushels) of coke, which returned us a profit of 93,000 frs. (£3,720).

"This manufacture very satisfactorily completes the entire series of processes employed by the company for utilizing their residuals, and we are now able to affirm that the whole of the coal received into our works leaves them in the shape of merchantable products without loss or waste."

THE BRITISH ASSOCIATION OF GAS MANAGERS.

This society held its 13th annual meeting in London, on the 13th, 14th and 15th of June, and seems to have been a success in every way. In our next we hope to give a part at least of the President's address, but we refer now to one point of his remarks as being particularly applicable to our own society, viz., "The continued success of the association depends very much on the number, but more especially on the character of the papers read at the annual meetings." The President, Mr. Robert Morton, has been connected with this association from its beginning, and should be a good judge of the requirements for its success. Let our association then take the benefit of his experience and begin at once to move in this direction. We have repeatedly called the attention of the members of the American Association to this point, and we sincerely hope that before the next meeting there will be some papers prepared that will be a credit to the gas makers of America. It is no use to try to shirk the responsibility. Our reputation abroad is to a large extent dependent upon the character of the meetings of the American Gas Light Association. Now if the best minds among the gas managers of America are satisfied with what has been done at these meetings heretofore, any appeal that we can make would be useless. If they are not, let *them* put a shoulder to the wheel and bring it up to standard. It is no excuse that they "do not belong." They should not only belong to it but control, direct and elevate it, and if the only take a moderately active part in the proceedings their influence is sure to be felt and made apparent. The old conundrum about the dog wagging his tale contains a great deal of true philosophy.

THE STEVENS INSTITUTE OF TECHNOLOGY.

The second annual commencement of this Institution was held on June 30th. The exercises consisted of an admirable address by the President, Prof. Henry Morton, who, after referring to the status of the science of engineering 100 years ago, and comparing it with the present, pointed out clearly the advantages accruing from a thorough education for the engineer and the great benefit that practical men may derive from a knowledge of the principles which govern and underlie all correct practice.

Then followed the reading of abstracts of some of the different Theses which had been prepared by the graduating class. The following are the subjects of the papers read after the salutatory address by Edward B. Wall: Project for erection of two Blast furnaces, by William Kent. Transmission of power by Wire Ropes, Albert W. Stahl. The manufacture of Illuminating Gas, Alfred P. Trautwein. The Theory of Windmills, Alfred R. Wolf. The paper upon illuminating gas was a very full history of the process of gas making up to the present time, and bore the evidence of careful study and good understanding of the principles of the science. Amongst the distinguished guests present was Prof. F. Reuleaux, the Principal of the Berlin Institute of Tenchnology, who delivered a short address complimenting the students, and predicting a bright future of usefulness for Stevens Institute.

After the conferring of Degrees upon the graduating class, the valedictory address was delivered by Mr. T. Mather Wallis. Thus a second band of educated engineers are sent forth by this young institution. Amply endowed and ably organized and officered with a corps of professors of the highest ability; merit is the sole critereon by which the student is judged, and if he passes through successfully it is certain that he is bound to exercise an important influence on the future of American engineering.

HEAT UNITS IN GAS BURNING.

We give in another column an extract from a report made by Mr Robert Briggs upon the ventilation of the Hall of Representatives in the capitol at Washington, which we are confident will be read with interest by all those managers who are anxious to increase their day consumption for domestic and mechanical purposes. In a few clearly stated sentences the full *heating* power of illuminating gas is given. This is a matter of great importance in connection with the extension and increase of gas consumption.

MR. YOUNG ON CONDENSATION.

We ask for a careful reading of the paper by Mr. Young, before the West of Scotland Association, a part of which, with the discussion following, we published in our last number. The paper and the discussion of it should be considered together, in order to fully understand Mr. Young's position. It should be borne in mind that the coals used mostly in Scotland are cannels, and by his analyser or condenser the naphtha vapours in the tar are kept volatilized by heat (either of steam or otherwise) and the portions of these vapours, not absorbed by the coal gas in passing through this arrangement, he proposes to utilize by sending water-gas, or gas of a low illuminating power through either with or after the regular working. This would in fact make the use of water-gas an auxiliary simply to increase the yield. When the question of dollars was introduced, Mr. Young admitted the great advantage would be where coal was very expensive.

The Beckton Gas-Works.

[Concluded from page 23.]

Each retort-house has two chimney shafts (which have been recently described in the *Journal*) and three ventilating shafts. These, in combination with the height and width of the building, render the temperature of the house, except in the immediate vicinity of the benches, little above that of the external atmosphere. In the galleries connecting the retort-houses together, are dining-rooms, kitchens, lavatories, and baths, this being one of several points of consideration for the comfort of the men.

As already stated, the retorts are set eight in a bench. The hydraulic main is rectangular, and of wrought iron, divided and separated in lengths corresponding to every ten benches, a main being carried from each division to an 18 inch main in the coke vault on each side of the retort-house. These join a 24-inch main underground, and continue to the condenser.

Each retort-house is calculated to produce 2,500,000 feet per diem, and is provided, and in communication, with its condenser. These are formed by 220 lengths of 12-inch main, making in all a total length of 2,600 feet, or one foot run per 1,000 feet. The theory of these vessels demands a few words of observation. It is well-known that sudden changes of temperature produce remarkable effects. Steel, as our readers are aware, when suddenly cooled, becomes exceedingly hard and brittle. Glass vessels, if not slowly cooled or annealed, are very susceptible to break spontaneously, and some metals, when dropped into water in a molten state become granulated. Glass, when submitted to the same operation, becomes disintegrated into the most minute particles. There was every reason, therefore, to conclude that gas might be similarly influenced; but only within the last few years have we learned that when submitted to a sudden change of temperature, it is deprived of some of its rich hydrocarbons, which are deposited in the mains in a crystallized form as naphthaline, thus obstructing the passage of the gas and deteriorating its quality. It is further understood that when crude gas is retained for a long period in conjunction with the tar, some of the most troublesome impurities are absorbed by the latter. Lastly, by exposing the gas to a large rubbing surface, the tarry vapors are retained, and do not pass to the scrubber. Hence in the system of condensation employed at the Beckton works, we find the three objects of gradual cooling, the gas held in contact with the tar for a long period, and the rubbing surface, combined–all *desiderata* for effectual condensation.

The first scrubbers erected at these works were so limited in height as to require the liquor to be pumped through the vessels a second or third time, in order for it to acquire the requisite strength. Recently six other scrubbers have been erected, each of them being sixty feet

high. Pure water entering at the top absorbs all the ammonia during its progress downward, until at the point of issue it obtains the strength of 20-ounce liquor. A matter for surprise at this establishment, where economy is sought in every way, is that hitherto the company have not profited by the manufacture of ammonia, the whole of this being sold in the liquid state, and necessarily the expense of carriage and manufacturer's profits are lost. It may, however, be stated that the company, by a bill they are promoting this session, and which has already passed the House of Commons, seek power to acquire a piece of land, 24 acres in extent, on the east side of the works, for the express purpose of manufacturing their residual products.

At these magnificent works there are, at present, six gasholders, four of which are single-lift, and of the respective capacity of one million feet, the other two are telescopic, each of the capacity of 1,500,000 feet, making a total storage of seven million cubic feet, which is estimated at only one-third of the maximum day's make during the next winter. Two additional gasholders are ordered of two million feet each. As there is nothing new or different in these holders, except their size, from those formerly employed by the company at their other stations, little is required to be said concerning them.

From Beckton there are two 48-inch mains, which convey the gas for storage at Bow Common and Westminster, and for distribution to the stations at Whitechapel and Goswell Street, which are termed distributing stations, and from there the gas passes through about 1200 miles of main-pipe and services, and probably six times that length of fittings, making, in all, something more than 8,000 miles of piping through which it travels hourly during the hours of consumption, and telegraphic communication exists between all these points and the works at Beckton.

The maximum daily make during the approaching winter will be 21 million feet, produced from about 2100 tons of coal, yielding 2100 chaldrons of coke, of which 1470 chaldrons will be delivered daily from the works, and about 200 chaldrons of breeze. In addition to this, there will be produced about 250 butts of ammoniacal liquor and 600 barrels of tar, which will be carried away in tank barges. These products, together with the quantity of coal received, must, at times, tax even the extraordinary power employed in conveyance. The weight of the maximum daily make of gas will be approximately 320 tons, and its illuminating power, burning, say, for six hours, equal to 10 million candles lighted during the same period. This gives something like the light of 7 candles as being required nightly in the depth of winter to light each individual residing in the Metropolis, including the public lamps, manufactories, shops, dwelling-houses, and places of amusement, etc.—the calculation being based on the whole consumption and population.

Passing from the retort-houses, we were struck with a site of ground of about two acres entirely occupied by retorts, intended for resetting in old benches, and this will convey some idea of the magnitude of the operations.

Each retort-house has its separate set of purifiers and station-meter, the magnitude of which is in keeping with the rest of the establishment. The method of purifying here observed differs materially from that generally adopted in gas-works, where the foul gas first passes into the foulest purifier, from thence to others, leaving the clean purifier the last. At Beckton the gas is purified, to a great extent, by means of the scrubbers, which deprive it of a great deal of its impurity; it is then passed into the lime purifiers, where it is completely purified of the remaining impurity. No oxide of iron is, at present, used at Beckton; but, it is hoped, that some means will shortly be devised to dispense with the use of lime, which is very expensive, and a great nuisance. Lastly, there is a check or "catch" purifier, by which any casual trace of impurity is removed.

The system of purification is so complete as to leave nothing to be desired, and the sulphur compounds, which for years contributed so much to the annoyance of our engineers, and where lime could not be used, are now removed, with positive certainty, so much within the limit prescribed by the Referees under the company's Act of Parliament, that they seldom exceed 10 grains per 100 cubic feet.

In the laboratory the gas is tested as produced both for its illuminating power and purity, every two hours.

The isolated position of these works requires that they should be as far as possible self-dependent; and for the purpose of repairing their engines and machinery, as well as to produce and repair articles of daily necessity, there are some excellent workshops, which will bear favorable comparison with many small engineering establishments. Here are forges actuated by steam-blowers, lathes, planing machines, drilling-machines, as well as machines for slotting and shaping, and even a steam hammer. Thus, in the event of disarrangement in any parts of the machinery, the appliances exist by which it can be speedily repaired.

In the neighborhood of the workshops are two lime-kilns constructed on the continous system, the chalk and breeze (which is used for fuel) being supplied in layers at the top, and when the former is properly calcined, it is withdrawn from below, thus securing a constant supply of fresh lime, either for the purpose of purification or building operations, as may be required.

As shown in the plan given last week, there are several cottages erected by the company for their workmen, all of which are inhabited, and their cleanly external appearance conveys a favorable impression of the comfort within. Near to these cottages is the "canteen," which the company have very considerately provided, and now conduct for the comfort of their men. Here refreshments of various kinds are provided, and all irregularity or excess is strictly prohibited. Meals are provided at regular hours for the men, at the most moderate charges, and we were assured by the attendant that the company, desirous of supplying at cost price, actually sustained a slight loss on every dinner furnished. A capacious and lofty hall, capable of accommodating about 200 men, serves as a dining-room.

The number of persons employed on the works in the depth of winter, is about 2,000, and to their great credit, as well as to that of the various officials controlling them, a single policeman is sufficient to maintain order, and indeed his services are but rarely called into requisition. A large number of the men live at Canning Town, about 3½ miles from the works, the company's line of railway, as represented on the plan, is in communication with that of the Great Eastern Company, and the men are conveyed to and from their work at a mere nominal charge, sufficient, we suppose, to remunerate the railway company. Certain trains leave Fenchurch Street daily, direct for the Beckton works. Perhaps this is the only instance of a railway ten miles in length, communicating with, and issuing tickets for passengers to, a gas work.

We are led to the conclusion that the considerations for the comforts of the workmen, by the construction of ample healthy retort-houses, and dwellings in the immediate neighborhood, by the facilities of transit to and from their employment, the erection of lavatories and baths on the works, and the establishment of the canteen, controlled by a disinterested manager, together with the avoidance, as far as possible, of Sunday labor, all tend to elevate the character of the men, and create a better feeling between workmen and their employees. In confirmation of this opinion, we were informed by the engineer, Mr. Trewby, who very kindly conducted us over the works, that notwithstanding the isolated position of the works, and that the wages paid were somewhat lower than at other metropolitan works, they had no difficulty in obtaining hands, thus clearly establishing the pleasing fact, that considerate treatment is properly appreciated by working men.

On our recent visit to the works, contrary to the general experience, we did not see a particle of tar throughout the premises. This, with the ammoniacal liquor, is conducted into tanks beneath the ground, by steam power pumped into the barges, to be conveyed to the manufacturers of these residuals.

To give a further idea of the magnitude of these works, we may state that the combined length of the charging-floors of the retort-houses is about 2200 yards, or 1¼ miles. Of course, the coke-holes, the viaducts in the retort-houses, the hydraulic mains, all are of a correspoding length. There are approximately 4400 mouthpieces, and nearly nine miles of retorts placed in their benches. The ovens, or arches of the benches, are upwards of a mile in length; and, roughly estimated, about ten miles of railway, including the high and low level, exist on the company's works.

Having attempted to describe this colossal establishment, we unhesitatingly assert that no other system could possibly equal, either on the point of utility or economy, the arrangement of viaducts and rails—the high and low level. The former, to use a technicality, may be termed the inlet for the works, as all the material for the production of gas enters thereby; whilst the low level, with the two 48-inch mains, may be termed the outlet, as by these means the residuals and gas are conveyed from the works. And by these two, the high and low level being kept distinct, the operations of the company are conducted with the same ease as was formerly the case at the small stations at Westminster and Brick Lane.

It must be, moreover, stated, that the order existing throughout the whole of the establishment, the absence of noise, the extreme cleanliness, more particularly in certain departments, such as the engine and exhauster house, the meter-house, together with the brightness of the machinery, all indicate the greatest care and the best management, and reflect the highest credit on all concerned.—*London Journal of Gas-Lighting.*

Uniform Weight of Coins.—The American Metrological Society has, through its president, memoralized Congress for the preparation of coins, of metrical weight and uniform fineness, and for the passage of laws and conclusion of treaties whereby such coins shall become legal tender, according to their weight.—*Popular Science Monthly.*

"Doing business without advertising is a good deal like trying to borrow a flag on the Fourth of July."—*Danbury News.*

West of Scotland Association of Gas Managers.

[From Report in London "Journal of Gas-Lighting."]

[Concluded from page 26.]

To understand how gas should be condensed, the tars proper removed, and the hydrocarbons left in the gas, we cannot do better than take a lesson from the tar distiller, who, when he desires to separate the naphthas from the tars, employs what is known as the "Coffey" still, consisting of a vertical chamber, into which are placed a large number of trays or shelves. Into the top of this chamber he pumps the tars, which run down from shelf to shelf, at the same time introducing an atmosphere of steam at the bottom, which, meeting the current of tars, heats them, and absorbs from them the vapors of the naphthas; the mixed vapors and steam being drawn off at the top and condensed; while the tars, denuded of the naphthas, flow from the bottom. On very similar principals should the process of condensation be conducted, only as the tar distiller gets his tars condensed, and in the liquid form, whereas we get ours in the crude gases, first as vapor and finely divided carbon or soot, or in the form of suspended tarry particles floating through the gas, the general arrangement of the "Coffey" still has to be so modified that those solid and liquid matters may be allowed to settle out, and the atmosphere of the crude gases themselves employed to suspend the vapors of the volatile hydrocarbons till removed from the sphere of the absorbent action of the tars proper, the gases being then allowed to cool and deposit the surplus vapors, to be afterwards employed to carburet poor gases, or those not already saturated with vapors.

To attain these conditions, it is essential that the gases be allowed to travel slowly, and that the tars be kept in a heated condition as long as they are in contact with the gases. The shelves in the analyzer, or "Coffey" still, must be set wider apart than is usually the case, and the shelves or trays made double to admit of steam being employed to keep the tars hot. As most of you are already aware, such is the form of apparatus which it is proposed to employ to overcome the defect of what I may be allowed to style the diffusive mode of making illuminating gas from coal.

I have here a sectional model of such an apparatus, which is similar in construction to that shown by a sectional drawing at our Lanark meeting (See JOURNAL, vol. XXV., page 805), and identical in form to that recently erected at the Corporation Gas-Works, Hamilton, and exactly 1-12th the size. As some of the members present to-day may not have been present at the Lanark meeting, I will briefly recapitulate the description of the working of this arrangement given at that meeting. This analyzing arrangement consists, as you see, of a vertical tower or chamber, having tray diaphragms placed at intervals, and arranged in such a manner that the gases, in passing between those trays, are caused to travel in a tortuous course alternatly from the centre to the sides, the apertures through which the gases have to pass being alternately at the sides and the centre of the trays. The trays are so formed as to hold a few inches in depth of tar or liquid hydrocarbons. Hanging from the edges of the central apertures of the trays, and dipping into the tars or hydrocarbons contained in the trays underneath, are tubes of wire gauze. Two of the lower trays, and the bottom of the lower compartment, are, as you see, double, and into the space steam is admitted to keep the tars heated.

The crude gases, suspended finely-divided liquid tars, and water enter by this pipe at the bottom, and pass over the tars, which are kept hot by the steam in the manner just described. The heated tars give off any volatile hydrocarbons they contain, which, on diffusing through the gas, come into contact with the mechanically finely-divided tarry particles suspended in the crude gases, and being absorbed by them, add to their weight, and tend to make them coalesce and settle out, or separate as they pass through the first wire netting hanging from the lips of the second tray. The tars as they settle out or run back into the trays or jacketed bottom become heated, and again part with the absorbed volatile hydrocarbons to carry down a further quantity of tarry particles, or, if not needed, or in greater quantity than required, they pass on with the gas. This process is just repeated at each of the other two jacketed trays, the volatile hydrocarbons being alternately volatilized by the heat of the steam and the diffusive action of the gases, and the tar particles are, so to speak, washed out with the hydrocarbon vapors. The crude gases are then further fractionally condensed as they gradually ascend from compartment to compartment, depositing the denser hydrocarbon vapors, and retaining or absorbing more of the lighter ones flowing from each successive tray, till, on reaching the outlet pipe leading to the scrubbers, they contain a very small quantity of tars proper, but are saturated, or contain as much of the hydrocarbon vapors suitable for carburetting the gas as they can hold in diffusion at ordinary temperatures, or as much as may have been present in the trays.

A short time after making the communication at Lanark, and whilst making further experiments with this arrangement, we discovered that, however perfectly a gas was charged with the hydrocarbons produced along with it from a given coal, yet there were always more or less hydrocarbon vapors left in the upper trays of the arrangement, which, when a poor gas from another coal was brought into contact with them, were taken up and diffused through it—*i.e.*, it was found that, on treating the gases produced from any of the rich cannels or shales, by passing them through such an arrangement as this, then passing the gas produced from a poor coal, giving, say, 14-candle gas, through the arrangement containing the residual tars and hydrocarbons, there would be produced, not, say 15 or 16 candle gas (which might be expected from the more complete diffusion of the hydrocarbons produced from the poor coal itself), but gas having an illuminating power of from 23 to 25 candles. Those results naturally suggested the use of water gas (hydrogen and carbonic oxide) to absorb and suspend the surplus hydrocarbons left in the arrangement when a rich coal was distilled. Experiment proved the practical suggestion to be correct,, for, on making trial of water gas, there was obtained a large increase of volume and a considerable gain in the gross sperm value.

It will be evident to your practical minds that there are considerable advantages in being able thus to utilize the hydrocarbons from a rich coal. You will observe that the surplus hydrocarbons from the earlier stages of the distillation of a charge of coal are not lost by being condensed and removed amongst the tars (as is the case where ordinary modes of condensing are employed), but that they are volatilized by the heat in the lower trays, and left behind in the upper and cooler trays of the arrangement till taken up by the poor gas produced during the latter stages of the distillation; and that, in a similar way, a poor and a rich coal may be distilled separately, yet advantage taken of the surplus hydrocarbons from the rich coal to carburet the poor gas; and that, when the hydrocarbon process is worked, it is not essential that the water gases and bituminous gases be made at the same time, but that the bituminous gas may be made first, the surplus hydrocarbons fractionally condensed out and left in the upper trays of the arrangement, and the water gas afterwards made and employed to absorb and take up those vapors, and form illuminating gas.

I dare say most of you, on looking into a retort, on the lid being removed to discharge, will have observed the beautiful coraline deposit of carbon hanging from the roof of the retort and formed on the external surface of the cokes even of coals and shales, whose cokes are worthless as fuel. We are all also disagreeably aware of the constantly accumulating deposit of carbon on the inner surface of our retorts, both forms of deposit being, as you are aware, produced by the decomposition of the volatile products of the coal. The former deposit of carbon is at present lost, for it is so friable that during the drawing of the charge it is crushed to powder; and the latter deposit is a source of considerable annoyance and loss. Now one of the advantages of this new diffusive mode of conducting the hydrocarbon process is that, instead of those deposits of carbon being a source of loss and annoyance, they may be made the source of considerable gain, for of all forms of carbon suited to the decomposition of steam into carbonic oxide and hydrogen, this finely-divided deposited carbon is the best. Thus we are enabled to first charge our retorts with coal, distil out the volatile carbonaceous portion as gas and hydrocarbon vapor, then in an arrangement such as that before us, by which the surplus hydrocarbons are retained, and on the distillation being completed, or nearly so, by introducing steam, we employ the deposited carbon to decompose it into carbonic oxide and hydrogen, to take up those surplus hydrocarbons left in the arrangement, and with them form illuminating gas. In the same way, many of our shales giving abundance of hydrocarbon vapors and rich gases, but having a coke worthless as fuel, may be economically used, for a portion of their carbon may be used to assist in the decomposition of steam, and form water-gas to take up the abundance of hydrocarbons produced, when they are carbonized.

But although it is not essential that the bituminous gases and water gases be made at the same time, yet, when this can be conveniently done, it is better the water gas be passed into the retort containing the bituminous coal or shale, and there mingled with the crude bituminous gases as they are eliminated, for it appears from the results of experiments that the poor gases serve to shield from over-decomposition or in some other manner conduce to the formation of a greater quantity of the hydrocarbon vapors suitable to carburet the water gas. A simple way to accomplish this is to make the distillation of the bituminous and water gases alternately in two retorts, connected in such a manner that the gases may be passed alternately from the one to the other; or where through retorts are used, by making the bituminous gases in the one end and the water gases in the other, and causing the water gases always to travel over the bituminous matter on their way to the stand-pipe.

The quantities of water gas (hydrogen and carbonic oxide) required to take up and hold in diffusion the hydrocarbon vapors produced from any given coal or shale, and therewith form a gas of the desired illuminating power, must first be ascertained by trial, by distilling a weighed quantity of coal, and adding water gas in the manner proposed to be worked till the desired illuminating power is attained. The requsite quantity being ascertained, it is only necessary to note that there is registered by the station-meter the proper quantity for each ton of such coal carbonized. Thus, say that one ton of rich shale is used, giving 8000 cubic feet of 38-candle gas, and that the hydrocarbons produced simultaneously are able to carburet water gas to such an extent that before the whole bulk of the mixed gases is brought down to 28 candles (that being the illuminating power of the gas desired) they amount in volume to 14,000 feet. Then all that is necessary is to see that for every ton of such shale carbonized there is registered by the station-meter 14,000 cubic feet, for whether the bituminous and water gases be made alternately or simultaneously in separate retorts, the action of the analyzing arrangement is such that the gases are carburetted, for should the water gases not be in sufficient quantity to take up the whole of the hydrocarbon vapors simultaneously produced, the surplus is deposited in the upper trays of the analyzer; and, on the other hand, when the water gases are more than sufficient to take up the hydrocarbons from the bituminous gases, then the previously condensed surplus hydrocarbons contained in the trays serve to supply the deficiency.

Such is the general *rationale* of the simplest means of conducting this method of gas manufacture; but there are many modifications of it to suit the varying circumstances of gas-works, the nature of the bitum

inous material employed, &c., to take notice of which would extend this paper to far too great a length. I must, therefore, refer you for further information on the subject to the specification of patent dated Aug. 3, 1875 (No. 2725).

As the means employed in conducting this process, for the utilization of the volatile hydrocarbons, are such as to prevent the direct action of the tars and water on the ammonia and other impurities in the crude gases, it is evident that the crude gases must pass from this new analyzing arrangement containing far more ammonia, sulphuretted hydrogen, carbonic oxide, sulpho hydrocarbon compounds, &c., than when the ordinary condensers are employed. At first sight, this might appear a very great objection; but if we give a little consideration to the matter, we shall see that such is not the case, but that from various reasons, over and above those already referred to. the present modes of applying the water and tars during condensation to absorb the impurities from the gas are objectionable.

Now when the horizontal and other similar forms of condensers are employed, and the water and tar made to travel along the bottom of the pipes in contact with the gas, or suspended in fine particles through it, there is not the least doubt but that the thin film of tar, more or less covering the water, impedes its absorbent action; and further, there is this defect in this mode of applying water, that just in proportion as the water takes up the ammonia from the gas, its power to absorb more is diminished; because not only is the affinity of the water for the ammonia lessened, but the relative diffusive action of the gas is increased till it is such as to hold in diffusion what ammonia remains combined with it.

It is quite evident that by causing a limited quantity of water to travel in the same direction as the gas, it is impossible to deprive it of all its ammonia, for, however weak the solution of ammonia may be, there is always left diffused through the gas a quantity, more or less, dependent on the strength of the ammoniacal solution formed. But if, on the other hand, we reverse the manner of applyng the water, by causing it to travel against the current of gases, it is evident that, as the water enters where the gases are passing, it is almost deprived of its ammonia by the water it has met in its course. The strong diffusive action of the gases for the remaining traces of ammonia will be overcome by the equally strong solvent action of the pure water, and as the water travels against the current of gases, this balance of affinity is continued, for gradually as the water absorbs ammonia, and loses a part of its absorbent power by flowing against and meeting the current of crude gases, it is as constantly brought into contact with gases richer in ammonia, part of which it is able to absorb; and gradually as the gases, on the other hand, are deprived of the diffused ammonia, and their diffusive action, for what remains, relatively increased, they meet with water containing smaller and smaller quantities of ammonia in solution, and consequently have a stronger solvent action for what ammonia remains in the gases. So far, then, as the action of the water on the ammoniacal compounds alone is concerned, this process is not objectionable, for the water as it leaves the bottom of the analyzing arrangement may, to all intents and purposes, be said to be pure, only containing, as it does, traces of ammonia and small quantities of the acid and alkaline and denser hydrocarbons in solution, which do not appreciably affect its action on the ammoniacal compounds in the crude gas; and, therefore, by cooling this water, and employing it in the manner indicated, by causing it to travel against the current of gases, as is done in the ordinary scrubbers, or by employing it in an arrangement similar in its action to that recently given and described in the *Journal of Gas Lighting*, by Mr. George Anderson, of London, it will be evident to you that the same quantity of water might be made to take up a much larger quantity of ammonia, because the gases, when brought into contact with the already strong ammoniacal liquor, contain all the ammonia produced with them, and, therefore, capable of adding to the strength of the solution. This is of considerable advantage where the solution of the ammoniacal compounds has to be carried to a considerable distance to have the ammonia extracted.

There is also another objection to the present mode of applying the water to absorb the ammoniacal compounds from the gas, to which I do not think sufficient attention has been given. I dare say most of us are more or less conversant with Mr. Hills's new process of purification, by the employment of the ammoniacal liquor to remove the sulphuretted hydrogen and carbonic acid from the gas. You are aware that in order to revive or render again partially caustic the ammonia, he by suitable means heats the crude ammoniacal liquor, which has the wonderful effect of causing it to part with the greater portion of the sulphuretted hydrogen and carbonic acid gases held in solution by the water, and combined with the ammonia, the solvent action of the water for the ammoniacal gas being apparently so great that, at the particular temperature employed, the ammoniacal salts are decomposed, the gaseous acids liberated, and the ammonia held in solution by the water.

Amount of Heat Resulting from Combustion of Illuminating Gas.

BY ROBERT BRIGGS, C. E.

[We have just received a report on the ventilation of the Hall of Representatives and the south wing of the Capitol, at Washington, by Robert Briggs, C. E., to a commission appointed to investigate the matter. Referring to the ammount of air to be supplied for the combustion of gas necessary to light the hall, and the increase of temperature resulting therefrom, appendix "B" of the report gives the following. We regret that our space will not allow us to give the whole paper.]—ED.

We give the following extract:

"There is another question involved with the temperature of the roof space at times, which does not admit of so ready solution as that of the abstraction of heat from the roof surface by external influences. The lighting of the Hall by gas burners above the roof calls for a large combustion of gas. About 5500 cubic feet of gas each hour is burned whenever the Hall is lighted; calling for 1900 cubic feet of air per minute for combustion only, and generating heat enough each minte, to raise the temperatnre of 50,000 cubic feet of air, from 70° to over 125°, (if no loss of heat at the roof or ceiling occurs.) The temperature of the gases of combustion, allowing a double volume of air for dilution, and supposing one-half the heat to be radiant, or emitted from a flame of gas light, is very great (1300° Fah.), while the absolute temperature of the flame is certainly above 5200°; and the radiation of heat from these lights is very perceptible, even to those who occupy seats 30 feet below; and especially noticeable in summer, when the increment of heat, above (say 85° or 90°), becomes oppressive. No means of alleviating this effect of radiant heat, or of reducing the quantity of heat which accompanies a given quantity of gas burning, when the gas is of given quality, has yet been found. But the great object of my calling attention to the gas burning at all, is to have kept in mind, that whatever scheme of ventilation of the Hall may be essayed, the provision of air for the gas burning, and the ventilation of the roof space must be fully considered.

Common coal gas has the following constituents per hundred parts: Hydrogen, H_2, 44 to 48; marsh gas, CH_4, 34 to 38; olefiant gas, C_2H_4, and other hydrocarbons, etc., 6 to 8; carbonic oxide, CO, 5 to 7; carbonic acid, CO_2, 1 to 3; air, N_2O, 1 to 3; aqueous vapor, H_2O, (saturation at 40° to 60°,) 1 to 2. The specific gravity of coal gas is about 0·430, which makes the volume of a pound of gas at 70° equal to 31·4 cubic feet (neglecting fractions, too small to be of consequence in this estimate) = 0·0318 lbs. per cubic foot. Taking an average of the constituents of coal gas, they can be reduced to 53 parts of hydrogen, 34 parts of carbon and 6 parts of carbonic oxide, which are combustible; leaving 5 parts of non-combustible substances. From these data, the heat given out by *complete* combustion can be calculated—hydrogen gas will evolve in its chemical change to vapor of water (including the latent heat of the vapor) 62,000 units of heat, while carbon in becoming carbonic acid, evolves 14,500 units, and carbonic oxide, in changing to the same form, evolves 4,400 units—with the following results:

UNITS OF HEAT FROM COMBUSTION OF 100 POUNDS OF COAL GAS.

Combustibles.	Oxygen requred.	Air required to supply oxygen.	Air required to effect complete combustion.	Units of heat per lb. of combustible.	Units of heat, total evolved.	Product.
H_2O 54	432	1,944	3,888	62,000 =	3,348,000	$H_2O = 486$
C 35	93	420	840	14,500 =	507,500	$CO_2 = 142$
CO 6	8	36	72	4,400 =	26,400	
Total, 95	533	2,400	4,800		3,881,900	628
	Deduct latent heat of 486 lbs. vapor@1000°,				486,000	
Total units of heat from 100 lbs. coal gas (95 combustible + 5 of non-combustible).....					3,395,900	

Of this quantity, of 34,000 units of heat per pound of coal gas, it does not seem to be an improper assumption, that one-half will be dispersed as radiant heat, and the other will be communicated to the gases of combustion, and deseminated by convection and intermixture with the surrounding air. The limited base from which the flame of a gas burner emerges, as compared to the magnitude of the flame or burning surface, prevents the loss or expenditure of radiant heat upon the fuel (which again imparts its heat to air in contact before burning), and thus reduces the convected heat to its least quantity. This leaves the convected heat from one pound of coal gas, as equal to 17,000 units; and preserving the assumption, of the accompaniment of the air for combustion by one volume of air in addition, it will be found by computation based on the specific heats of vapor of water = 0·475, carbonic acid = 0·217, nitrogen = 0·245, and air = 0·238; that the specific heat of the melange equals 0·263, and the temperature of the gases of combustion (49 pounds), arising from the absorption of 17,000 units, will be 1,300°.

Again if we suppose a burner of 4½ cubic feet of gas per hour, which is equal to 0·00239 pounds of gas each *minute*, we find the dispersion of 40·05 units of heat by convection; and the same quantity of heat by radiation, in the same minute's time. At this rate, the 1,228 burners over the ceiling of the Hall of Representatives, will consume 5,526 cubic feet of gas per hour, and give out 49,181 units of heat each *minute* by convection. If the quantity of air passing away from the Hall is accepted at 50,000 cubic feet, also per minute, it weight (at 70°) is 3,700 pounds, and with the specific heat of 0·288, there will proceed 880 units of heat for each single degree of elevation of temperature; whence, in dissipating the 17,000 heat units, an increment of 56° will attend the intermixture of the gases of combustion with the vitiated; bringing the temperature of the foul air escaping from the roof space to 126°; or higher, if the air from the Hall is above 70°.

The radiant heat emitted from the burner would be expended upon the surrounding objects, which will either absorb or transmit it (in part); and the absorbed heat will be finally dissipated by convection to currents of air in contact with the bodies of absorption. A portion of the radiant heat will be transmitted through the glass (about 40 per cent. of what is emitted against it), to the room below, where it will be necessary to cool the air of ventilation correspondingly; but the most of the radiant heat will be imparted to the metal, and other surfaces of the roof space; where it would seem that eventually the heat would accumulate, until nearly the whole quantity of heat produced by the gas burning, radiant and otherwise, would have to be taken up. This would call for an increment of temperature of about 110°: giving 180° as the temperature of the foul air emerging from the roof.

In point of fact, it must be said, that the highest heat recollected by the writer, as having been observed in the roof space at any time, was only 115°—but that temperature is high enough to make the means for controlling the flow of foul air from gas burners the subject for serious consideration.

It may be well to give, as a final comprehensive statement, the fact that the 1,228 burners of 4½ cubic feet of gas per hour, will burn 5,526 cubic feet of gas in this time, or 176 pounds of gas; and each pound of gas will produce about 3½ times as much heat, as is given from the burning of a pound of coal, upon an ordinary boiler grate. From this it appears that the heat produced above the ceiling of the Hall by the gas lighting, is that which would be generated by the burning of 600 lbs. of coal per hour on a grate of about 50 to 60 square feet of surface.

This question of gas burning makes it proper that I should call attention to a disuse of one of the regulating provisions for supply of gas, which disuse, has been very injurious in its effects on the ventilation. There was originally in the line of main gas pipes, in the place now occupied by the suction fans, a gas governor, which controlled the flow of gas so as to preserve a uniform pressure in the building and to prevent increase of pressure, either when the great Hall system was extinguished as a whole, or when any change of pressure was made at the gas works, in forcing the supply of the city. This governor may be yet in existence, but out of order; but it was in working condition for six or eight years. In 1866 (I think) it was found by the writer, to the complete surprise of all the persons then employed at the Capitol, and it was then discovered to have controlled automatically for eight years—unrecollected and untouched, in constant motion every day, and almost every hour of the day—the admission of gas to the building, so that a *blow* or flare of gas had been an unknown occurrence.

At the present time the broken and s oked shades, the free discharge of gas where a burner had blown out, and the consequent smell of gas which pervades the building and is sucked into the Hall, are the consequences of the neglect or removal of this valuable regulator. * * *

Dr. Wartz's Great Chemical Discovery.

Chemistry is most truly an inductive science. Ever since the day when Priestly discovered oxygen, a century ago, its disciples have been carefully collecting facts from which to deduce laws and build a general theory of chemistry. One by one these laws have become apparent, and great minds have formulated them. One of the first and most important was that of combination by weight. Long after that the law of combination by volume appeared, and made quite a revolution in our formulas, a reform not yet introduced into all our schools, still less into practical life.

Chemistry has well been defined as molecular physics, and the application of physical laws to the molecules is becoming more and more general. From a study of the specific heat of gases, Ampere deduced the important law that "equal volumes of all gases contain the same number of molecules." This gave us some idea of the size of molecules in a gaseous state.

In 1855 Hermann Kopp took up the study of the size of the molecules in liquids and solids. Starting with the hypothesis that the volume of a molecule could be represented by the quotient resulting from dividing its atomic weight by its specific gravity, referred to water, he determined the molecular volume of a great variety of substances. His results will be found in Watts' Dictionary of Chemistry, under the head of "Atomic Volumes."

Quite recently Dr. Henry Wurtz, of Hoboken, took up the study of these molecular volumes, and found that if the specific gravity be taken at the point of incipient ice fusion instead of the boiling points, many of them would become, on being multiplied by 1000, perfect cubes of whole numbers. Let us take, for example, water, which has, in a fluid state, the density 1; and its equivalent, 18 divided by 1, equals 18, which is not a perfect cube. The density of ice is about 0·9145, which divided into 18 and multiplied by 1000, gives us $19{,}683 = 27^3$.

As oxygen is never seen in a solid or liquid state, it is necessary to calculate its volume from some liquid in which it occurs. Kopp took water at 100° C., and found its molecular volume to be $18 \div 0.9579 = 1818$, and subtracting the volume of 2 molecules of hydrogen at 5·5 each, he found for oxygen in water the molecular volume 7·8.

Dr. Wurtz obtained the molecular volume of oxygen by comparing the volume of water with that of peroxide of hydrogen, and ascribing the difference to oxygen. In this way he obtained for oxygen the molecular volume $5184 = 3 \times 12^3$, and according to his calculations, this never changes, while the atomic volumes of every other element, but especially hydrogen, do change. But the atomic volumes, both of elements and compound radicals, always change from one perfect cube to another. Hence he deduces his first law, which may be stated as follows: "The volumes of all single chemical molecules, whether of elements or of radicals, except oxygen, are expressed by quantities having the relation of even cubes of a series of whole numbers, that of ice being 27."

If this be true, and Dr. Wurtz brings a long array of figures to sustain it, this simple test for compound radicals will settle the question of writing most of our rational formulas in organic chemistry. Perhaps we should mention that Dr. Wurtz discards, or rather upsets, the whole theory of types, and throws out all of our alcoholic radicals, as shown by his alcohol formulas:

Methyl Alcohol.....	H_2O,H_3C
Ethyl "	$H_2O,2H_2C.$
Prophyl "	$H_2O,3H_2C$
Butyl "	$H_2O,4H_2C$

He is obliged to double, or quintuple, many formulas in inorganic chemistry; thus, H_2, Cl_2, for H Cl; H_{10} O_5 for H_2 O; H_{10} O_{10} for H_2 O_2; As_2 Cl_6 for As Cl_3; Na_4 Cl_4 for Na Cl. Thus in hydrochloric acid the molecular volume is 28,516, and subtracting the known volume of chlorine $24^3 = 13{,}824$, leaves hydrogen 14,692. As this corresponds to no perfect cube, he supposes there are two molecules of hydrogen present, one having the volume $24^3 = 13{,}824$ the other $25^3 = 15{,}625$. In chloride of potassium the metal falls between 28^3 and 29^3, so he again assumes two molecules, one of each size. Inasmuch as similar solids are to each other as their cubes, he thinks the above cube roots may represent the diameters of molecules, and thus designates them.

His second law, which he calls *Engymmetry*, states that the molecules which combine to form a new substance tend to assume very nearly the same size, hence we have in argentic chlorlde, two of silver, one having the diameter 22, and the other 23, while the chlorine is 24, making the series 22, 23, 24.

His third law, which he calls *Oratesis*, states that this tendency to vary in diameter increases with the basicity or electropositive nature of the element, so that while oxygen varies the least, or not at all, hydrogen and the metals vary most.

We cannot, of course, venture any judgment of our own on the merits and value of Dr. Wurtz's theory, but it has met with a most favorable reception by chemists, and is by them regarded as an important contribution to our knowledge of the theory of the constitution of matter. That a discovery so great should have been made by an American chemist and laid before the world at this time, is peculiarly gratifying. The progress of scientific investigation and research in this country is a matter of surprise to intelligent foreign visitors, but such work as that by Dr. Wurtz will place our chemists alongside the great est names of the Old World, even in the estimation of Europeans.—*Iron Age*, xvii., 26.

Health of Workmen in Gas Works

Dr. Petersen, municipal physician of copenhagen, has published the results of his researches respecting the maladies of the employees at the gas works of that city. The investigation was occasioned by a considerable increase of cases of desease among such workmen. Upon examining the reports for the previous twelve years, an increase was found, remarkable not only in number, but also in duration of the cases of each kind. Of 348 cases treated from November, 1870, to November, 1871, 66 were surgical operations and 266 were of four classes, viz, 96 were chronic or severe affections of the respiratory organs (62 simple catarrh, and 34 more serious maladies:) 50 were severe catarrhal affections, or chronic dyspepsia: 28 were general debility, with fever, and 26 were rheumatic affections. On inquiring into the conditions which caused the diseases, Dr. Petersen divides them into two classes—those of men employed at the retorts, and subject to violent variations of temperature, and those of workmen in other departments. About three-fifths of the men were employed in winter at the retorts, and one-third in summer. Among them, during the period above named, there were of catarrh 33 during the winter, and 7 in summer; of more serious respiratory affections 18 in winter and 4 in summer; catarrh dyspepsia, 12 in winter and 15 in summer; debility with fever, 12 in winter and 9 in summer; rheumatism, 8 in winter and 3 in summer. Of the 338 cases, 200 were among the retort tenders, The more serious respiratory affections in gas employees generally arise from prolonged catarrh, and for the most part consists of symtoms of bronchitis and phthisis. The general symptoms often indicates a more advanced stage of disease than is shown by outward sighs. Of the more serious respiratory affections, 11 per cent. were of persons possessing originally strong constitutions.

Although the individuals employed on the retorts are exposed to great variations of temperature, Dr. Petersen does not consider that sufficient to account for the frequency of catarrh, but believes there must be another source of the constant irritation of the breathing apparatus. At first view it might be supposed that the cause arose from sulphurous and other fumes generated in the works, but the retort house, in this case, is so well ventilated that the presence of gas is scarcely perceptible. In the purifying houses, the atmosphere of which is almost intolerable, bronchitis proper is unknown. In fact, it has for a long time been the custom in Denmark, and also in other countries, to expose infants affected with the whooping cough to the air of purifying houses, to which some special therapeutic virtue was attributed.

In the opinion of Dr. Petersen, mineral charcoal dust (coke dust) is an agent far more important than gas in the production of affections of the respiratory tubes. He fully agrees with the observations made by German savans, which disclosed that coke dust acts as an irritant of the mucous membranes, and penetrates into the respiratory tubes, where it is deposited, But he regards this deleterious influence as not so serious in its nature as others believe, who attributed it to catarrh, cachexy, and a form of phthisis. Hirt stated that vegetable dust was less hurtful than mineral dust (those of the harder vegetables and the

dust of stone for example:) that ordinarily, coke dust is among the less irritable substances, and that its rounded or polygonous particles traverse more easily the mucous than the angular particles of wood charcoal. In confirmation of this view of the subject, Dr. Petersen has observed that the expectorations retained hardly any trace of coal dust twelve hours after the patient had left the retort house, and in the autopsies made at the municipal hospital no case of pulmonary tubercles arising from this cause had been found. Coke dust, therefore, may be regarded as influencing considerably the production of simple catarrh, but as not directly deleterious in the more grave forms of diseases of the respiratory organ.

The fact of finding among these gasworks patients—many of them of a class originally robust—the worst forms of pulmonary affections, cannot be explained, except by the neglect of catarrhs, complicating a state of debility which their poverty may have prevented from being attended to in season. These diseases generally assume the form of consumption, are usually of long duration, and gradually render the patient unfit for work. A direct cause of death rarely occurs among workmen in gas works.

These causes of catarrhal affections of the intestines sometimes prove to be aggravated, and occur mostly in summer, assuming the form of vomiting and diarrhœa; other cases become chronic dyspepsia. In regard to the ethology of such affections, Dr. Petersen does not think that coke dust has much influence, if, indeed, it has any action. It would be more proper to refer these diseases to the general conditions of exposure in which the men work. They are employed in a high temperature, subject to violent draughts of air, necessarily causing an excessive and rapid evaporation of perspiration, attended always by great thirst, and often by loss of appetite. In circumstances so unfavorable to digestion, the laborer ought to use a proper and carefully prepared food. As, in practice, he cannot procure such provision, he inevitably has resource to alcoholic stimulents, which revive temporarily his wasted forces, and which. with large quantities of olive oil, become his chief nourishment, and at the same time ruin his health. He thus gradually falls into intemperate habits before he is aware; chronic and incurable gastric catarrh is produced, the digestion impaired, pulmonary disease becomes more or less developed, and this complication of diseases often causes a profound debility in those long employed in gas works.

The group of diseases already described under the name of debility, accompanied by fever, is characterized by a consumptive appearance, a pallid face and great prostration. This condition is often complicated by disordered digestion and signs of alcoholism. Such patients are often treated for mild fever, independent of any local complication, and the disease often presents the general character of continued fever without connection with typhoid infection. This condition is sometimes, but not in any evident manner, the result of digestive trouble, whether with or without alcoholism. In some cases, however, it occurs as a primitive affection, especially in workmen attending the re-retorts.

Dr. Peterson has observed a similar fact among cigar-makers, who, like the retort-tenders, work long hours, and remain in a high temperature. The author states that he has often noticed an attack of a sort of general debility, mild or acute, appearing after two weeks of night-work among retort-tenders.

As to rheumatic disorders, they must be referred to the sudden changes of temperature to which the gas employees are exposed, and they attack in about equal ratio retort-tenders and workmen in other departments. The usual form of rheumatism is the sciatic, and the number of cases reported annually is not numerous.

Among the diseases comprised in the list first mentioned are two cases of typhoid fever, 6 of parotidite, and three of smallpox. Dr. Petersen has heard that it is the belief among the employees of the gas work that retort tenders are less liable than other workmen to take infectious diseases, and that they are rarely affected by typhold fevers.—*Coal Trade Journal.*

Report on the Development of the Chemical Arts During the Last Ten Years.

BY DR. A. W. HOFMANN.

PRESERVATION OF ICE, by DR. H. MEIDINGER.

In breweries ice is still universally stored in walled pits, which are placed near the store cellars, and keep the latter cool. In Dreher's establishment the cellars occupy 113 cubic fathoms = 771·05 cubic meters, serving to store 3600 to 3800 eimer of beer = 2038 to 2151 hectolitres, and the adjoining ice pit contains 65 cubic fathoms (413·52 cubic meters) holding about 6510 cwts.(348·466 kilos). The ice pits have the defect of being costly in construction, and uncertain in their action. If ground water flows in over the floor, the ice melts rapidly. Where ice is stored up for sale in large quantities it is better to construct ice houses above ground, after the American plan, consisting essentially of double walls of wood with an interval of at least 0·3 filled with some bad conductor of heat, such as sawdust, chaff, loose peat, &c., in a dry state. Thus, the North German Ice Works at Berlin had, in 1871, an ice house 180 meters long, 24 wide, and 10 high, for the storage of 600,000 cwts. of ice. Such ice houses are cheaper than the subterranean ice pits, more conveninent in use, and preserve the ice better, if only the layer of non-conducting matter is thick enough.

The author has treated this subject at length elsewhere. Every season new methods of preserving ice are announced in the papers. None of these are at all novel in principle; they depend upon causing a heap of ice to freeze together, if possible, and then covering it with a bad conductor of heat, such as straw, moss, &c. This is in the south of Germany but an unsatisfactory method; far in the north, especially in Russia, it may succeed. Such coverings further, are very perishable. A cheap and effective ice house on a small scale can only be made in our latitude by preparing two cubic boxes, the inner measuring not less than 2 meters with an interval of at least ½ meter between it and the exterior box in every direction. This interval is not left void, but filled with chaff, chopped straw, dry spent tanner's bark. The only entrance is a door of the same thickness as the sides. According to calculation in a well-made ice house of this construction the ice scarcely melts in a year at the distance of 15 centimeters from the walls. To divide the interval between the double sides into several compartments alternately filled with a bad conductor and left empty—as occasionally recommended—is decidedly irrational, being more costly and less effective than a single well-filled broad interval. The air, though the worst conductor of heat, yet if it can move freely in a given space, rapidly transfers heat from a warmer to a colder surface. It is sometimes recommended, and even attempted, to improve a bad ice house by throwing a quantity of salt upon the ice. The author has shown that this is a very irrational procedure, since, although the cold may be increased to the senses, a considerable loss of ice ensues, the access of heat to the ice pit being accelerated by the augmented difference in temperature.

The preservation of ice is not only important on the large scale, but it is of consequence on the small scale in domestic operations. Food is to be kept cold and thus preserved from decay, or ice is to be used directly for cooling purposes. For this purpose closed boxes are employed under the name of ice cupboards or ice chests. The theory of these contrivances has been examined by the author. The ice closets are cupboards with double sides, the interval filled with chaff, &c., and the insides carefully lined with sheet zinc. The interval between the sides is often too small. According to the author's experiments, the entire breadth of the double side should not be less than 10 centimeters if the ice is to be preserved from rapid melting and a temperature of say 4° C. is to be maintained within. It is also preferable to place the ice in the entire upper third of the closet so that the lower two-thirds remain at liberty for food, &c. The entire cover is then made to open. The ice can then be easily taken out in pieces, and the whole lower space is equally cold, whilst if the ice is placed in a lateral compartment, as soon as it melts only the lowest part of the closet is thoroughly cooled.

Physical Society.

LONDON (ENG.), MAY 27, 1876.

Professor GLADSTONE, F.R.S., Vice-President, in the Chair.

Mr. W. Ackroyd read a paper on "Selective Absorption." Two typical experiments were shown upon which a division of selective absorption may be based. In the first, light is transmitted through bichromate of potash at the normal temperature, and again at about 200° C., and the spectrum of the transmitted light is examined. The widening of the absorption-bands, which takes place at the higher temperature, is traced to structural alterations. In the second experiment, light is sent through two thicknesses of the same colored solution—as, for example, sulphate of copper—and in the greater thickness the absorption-band has widened out; but this is plainly not owing to any structural alteration. That in the first experiment he proposes to term *structural*, and that in the second *transverse* absorption, and he considers that these two kinds have not hitherto been sufficiently distinguished. Certain color relations which exist among anhydrous binary compounds led the author to the conclusion that the width of a structural absorption-band bears a direct relation to interatomic distance. The necessity for separating high temperature spectra from low was shown, and the bearing of the subject on the study of organic coloring matters briefly alluded to.

The Secretary then read a communication from the Rev. R. Abbay, "On certain Remarkable Atmospheric Phenomena in Ceylon." The most striking of these is witnessed from the summit of Adam's Peak, which is a mountain rising extremely abruptly from the low country to an elevation of 7200 feet above the sea. The phenomenon referred to is seen at sunrise, and consists *apparently* of an elongated shadow of the mountain, projecting westward to a distance of about 70 miles. As the sun rises higher it rapidly approaches the mountain, and appears at the same time to rise before the observer in the form of a gigantic pyramid of shadow. Distant objects may be seen through it, so that it is not really a shadow on the land, but a veil of darkness between the peak and the low country. It continues to rapidly approach and rise until it seems to fall back upon the observer, like a ladder which has been reared beyond the vertical, and the next instant it is gone. Mr. Abbay suggests the following explanation of the phenomenon:—The average temperature at night in the low country during the dry season is between 70° and 80° F., and that at the summit of the peak is 30° or 40° F.; consequently, the low strata of air are much the less dense, and an almost horizontal ray of light passing over the summit must be refracted upwards and suffer total internal reflection, as in an ordinary mirage. On this supposition the veil must become more and more vertical as the rays fall less horizontally, and this will continue until they reach the critical angle, when total internal reflection ceases, and it suddenly disappears. Its apparent tilting over on the spectator is probably an illusion, produced by the rapid approach and the rising of the dark veil without any gradual disappearance which can be watched and estimated. It will be evident that the illumination of the innumerable particles floating in the atmosphere causes the æriel shadow to be visible by contrast. Another interesting phenomenon visible in the mountain districts admits of an equally simple explanation. At times broad beams, apparently of bluish light, may be seen extending from the zenith downwards, converging as they approach the horizon. The spaces between them have the ordinary illumination of the rest of the sky. If we suppose, as is frequently the case, that the lower strata of air are *cold-*

er than the upper, the reflection spoken of in the case of Adam's Peak will be downwards instead of upwards. If several isolated masses of clouds partially obscure the sun, we may have several corresponding inverted veils of darkness, like blue rays in the sky, all apparently converging towards the same point below the horizon. This latter phenomenon is called by the natives "Buddha's Rays."—*Chemical News.*

Liernur's Pneumatic Sewerage.

The following extract from the *Builder* refers to an investigation on which the severer critics of the Liernur system based some hope of its final overthrow; and the fact, that Mr. Haywood after a severe scrutiny has spoken of it so favorably as he has, will add materially to its claim for further investigation and experiment.

In accordance with instructions from the City Commissioners of Sewage, Mr. William Haywood, their engineer, has investigated Capt. Liernur's pneumatic system of sewerage, has conferred with that gentleman personally, visited Amsterdam and Leyden, where the system has been partially applied, and presented a careful and valuable report on the subject. Mr. Haywood sees the objections which may be taken to the system, as well as the advantages it possesses, and in conclusion says:

"That the pneumatic system is not perfect on all points, is certain; but its value must be considered by the side of the results of the existing system, with which it seems to me there is a growing dissatisfaction, and, as to its sanitary value, many doubts; and for that reason it seems to me important that the pneumatic system should have a full and fair trial in England."

He thinks it would be best tried in a poor district, where, the population being usually more dense, more excreta is produced from a given area; and where the consumption of water being less, and the condition of the ordinary siphon-pans more resembling that of the pans under the Liernur system, water-supply might be omitted or withdrawn from the closets without objection from the inhabitants. In the metropolis and in most of the great towns, under the Artisans' Dwellings Improvement Act, large numbers of dwellings for the working classes are likely to be built, and there the system could be tried under favorable conditions; in the suburbs of London, whole districts are also being laid out for the residences of those in very moderate circumstances, and there a similar opportunity offers itself."—*American Architect and Building News.*

Imperfect Drainage.

Perhaps one of the worst effects from the want of proper ventilation is that resulting from the escape of sewer gases from the drains and sinks of our dwellings. The danger of these foul emanations, carrying the germs of typhoid and diphtheria, cannot be too forcibly impressed upon the public; and since of late numerous severe cases of disease directly traceable to this miasma—not forgetting the sickness of Prince of Wales, occasioned by defective sewer pipes at Lownesborough Lodge—have been prominently brought to notice, it is time that some active measures should be taken to prevent their entrance. Traps in a measure check the escape of these odors from cesspools and sewers, but these are likely to dry up. Often, too, there is pressure from below, and it has been found that the gases force themselves through the water in the traps, passing into our apartments and are consequently absorbed into our systems. The only way effectually to prevent this is to have a vent in the soil pipe to allow the gases to pass off, by means of a small pipe conducted into the ventilating flue, or, if such is not at hand, into the smoke flue of a chimney. The leader pipes, when not connected with a cistern, would do for this purpose. They can either be joined to the soil pipe, in which case they would be thoroughly cleansed by a flow of rain, or, if connected with cesspool or sewer, they may act as direct ventilators from these. It is important, however, that their termination be not directly under an attic window, through which the odors might enter the house.—H. Hudson Holly, in *Harper's Magazine for June.*

Gas-Light Intelligence.

United States.

Fire at the New Gas Works—An Explosion—Two Men Badly Burned.—About 9.30 o,clock on Wednesday morning, June 21st, an explosion occurred in the carburetting house at the Citizens' Gas Company's works on Vail avenue. The roof instantly caught fire and an alarm was sounded from box 3. The fire department responded with usual promptness. Several streams were soon playing on the flames, and the fire was confined to the building in which it originated. When the explosion occurred Patrick McCaffrey, foreman of the retort-house, ran in the burning building with hose in his hands. An explosion of naphtha occurred almost immediately afterwards, covering him with oil and fire. His arms and breast were badly burned, but he sustains no internal injuries. When the fire was at its height the naphtha tank exploded, causing a great scattering among the spectators assembled, and several firemen narrowly escaped injury. The fire burned the roof off the building. The loss will not exceed $1,000, upon which there is no insurance. It is supposed the fire originated from gas generated by the naphtha becoming too strong for the cylinder, which exploded. The action will cause no cessation of business at the works. Jacob R. Dunn, of the Eddy steamer company was also badly burned.

The Gas House Fire Inquest—Conclusion of the Investigation.—Coroner Blackall concluded the gas house fire inquest last night at the third precinct station house. Patrick McCaffrey's testimony was unimportant, being simply a corroboration of the previous testimony. W. H. Green testified to what he knew about manufacturing gas. At the conclusion of his examination the following verdict was rendered:

That the said fire was caused by an overflow of naphtha or naphtha vapor from a supply tank located in the carburetting room, over the carburetter, and which took fire from causes to the jury unknown. Further, we do hereby censure the Troy Citizens' gas company. First, for the careless and improper location of the supply tank over the carburetter, which is heated to a high degree by steam, thus generating a vapor of naphtha, which escaped and filled the carburetting room and vicinity. Second, the supervision seemed to be faulty and inefficient; the superintendent not being aware of openings or a plug on the top of the tank, or the safety valve on the same, through all of which the naphtha must have made its escape. Third, since the beginning of this inquest the Troy Citizens' gas company have removed the said tank from the building, and are now taking their supply direct from their store tanks by an underground pipe, thus removing the great danger of the previous construction of the carburetting room, and thus virtually admitting the danger of the original construction by so doing.

The jury also passed the following resolution:

Resolved, That the Common Council of the City of Troy be hereby requested to take such action that the future methods of making gas be entirely safe to the community.

—The inquest has been a useless expense, and the gas company were unnecessarily censured. The verdict simply states that the fire was caused by naphtha, which was known the day of the fire, and that the exploded tank has been removed and will not be replaced. The company do not require it, else it would certainly be rebuilt. It was proved during the examination that the gas manufactured by this company was no more liable to explode than that manufactured in any other manner; also that accidents are as likely to happen in other manufacturing establishments as in the Citizens' gas works. The residents in the vicinity of the works have suffered needless alarm. The company assure us that there is no likelihood of another explosion or fear of danger.—*Troy Daily Times.*

Coal for Philadelphia Gas Works.—The $200,000 coal contract came before the gas committee of the Philadelphia councils on the 2d inst. Mr. Moore was present and read a paper, setting forth the reasons why the contract should have been given to him as the lowest bidder. Mr. McManus, for the Gas Trust, showed by letters and by the books which he produced that Moore's first bid was $6.10 per ton, and that his second bid of $5.90 was not made until after the contract had been awarded to other parties at $6. After brisk examination and discussion by members of the committee who were after the bottom facts, the whole matter was referred back to Councils with the recommendation that the committee be discharged, on the ground that Mr. Moore had had a hearing and had failed to make good his complaint.

Chemical and Scientific Repertory.

Cheap Fuel.—Cheap fuel being a great desideratum in the successful operation of railways, we observe with satisfaction every movement having a tendency towards producing it, especially those which purpose to utilize waste material. We notice this month that an inventor at Mauch Chunk has perfected a machine by means of which 150 tons of superior stove coal can be produced from coal dust at a price about 20 per cent. less than that at which the genuine material is selling. Another invention of much greater importance to railways is that of Superintendent Wootten, of the Reading road. It has always been known that coal dirt would burn fiercely if any means of forcing a draft through it could be devised, and this he accomplished by replacing the ordinary grate bars with a perforated iron plate, and introducing underneath a blast of steam. The result is said to be a perfect success, and with boilers so constructed any of the refuse coal, whether old or new, can be utilized, and as it costs only about one dollar a ton, the saving to the companies will be immense. It is only by efforts in this and similar directions that the problem of cheap transportation can be solved.—*The American Exchange and Review.*

Boiler Explosion at Bristol.—On the morning of May 8, at 11 o'clock, a destructive explosion occurred at the White Lead Works of Messrs. J. Hare & Co., in Avon Street, St. Philip's, Bristol. The works which are situated in a densely populated neighbourhood, extend from Avon Street to Waterloo Place, abutting upon which are the boiler houses and the sheet rolling mills. In the rear of the houses opposite the works in Waterloo Place are about forty small tenements, enclosing a triangular space known as Waterloo Square. It is said the engineer, Thomas Chilcott, had just got the steam up in one of a pair of boilers lying side by side when the explosion occurred. The boiler, weighing five tons, being thrown through the roof, and ascending in the air to a height of nearly 200 feet, it travelled in an oblique direction across the houses of Waterloo Place, smashing in window frames and scattering brick dust and mortar over the fronts of the houses. Ultimately it fell with a tremendous crash through one of the small houses in Waterloo Square, demolishing the rooms, with the exception of a front kitchen; and finally taking a slanting course, it fell into the middle of the square. Fortunately, although several persons were bruised and terrified, no one received serious injuries. Several persons, however, had most miraculous escapes.—*The Ironmonger.*

Improved Gas Cooking Stoves;—A few days ago we accepted the invitation of Mr. G. Shrewsbury to inspect his stock of gas heating and cooking apparatus, amongst which we noticed two improved articles deserving of particular mention. The first of these is his new "Princess" cooking range, which is a neat and convenient stove, measuring 32 inches in height, 15 inches deep, and 31 inches in width, with a hot-plate 32 by 16 inches. The capabilities of thi[s]

article are excellent, no space being allowed to rest unutilized. In fact, its arrangements may be said to comprise a large open roaster, a pastry oven, large copper, tin-lined boiler holding 4 gallons of water, a hot-closet heated by the boiler burner, and a hot-plate fitted with three patent burners, enabling it to be used for boiling, stewing, steaming, or frying, &c. One of the chief merits of this apparatus is that the oven is made with an air chamber on the bottom, top, sides, and back, so that a good equal heat is obtained without the viands being in any way affected by the gas, and a small flue in the rear conveys the steam, &c., away, preventing any unpleasantness on that account. The other improved apparatus consists of a large stove, designed to take the place of ordinary kitcheners, being large and capacious enough to roast a large joint or four fowls, while baking four tarts, and heating five or six saucepans. It will also broil chops or steaks and toast bread at a very small cost. The dimensions of this article are:—Height, 35 inches; width, 32 inches; depth, 15 inches; hot-plate, 23 by 16 inches.—*The Ironmonger.*

Utilisation of Waste Steam.—M. Tommasi has submitted to the Societe Francaise de Physique a method for the utilisation of waste steam. He uses it for expanding a liquid of low specific heat and great expansibility, such as oil. This expansion is effected in a strong vessel fitted with a movable piston, which gives off the effect of the expansion. By substituting a jet of cold water for the jet of steam, the piston is brought back to begin a stroke. The author has constructed an apparatus in which the force generated by the expansion of a column of oil contained in an iron tube was made to act on a plate of lead, kept in position by a steel diaphragm. Through a hole pierced in the latter was forced a cylinder of lead at an expenditure of work calculated by the author to be equal to that of 300 atmospheres.—*Ibid.*

Hardening and Tempering Glass.

From "English Mechanic."

The well-known Dresden manufacturer, Herr F. Siemens, has recently patented a method of hardening, tempering and pressing glass, which appears likely to become of more practical utility than the process of hardening discovered by M. de la Bastie. At the time when the latter's discovery was made public it was announced that Herr Siemens and others had been experimenting in a similar direction, and the accusation was freely made that Bastie's process was being pirated. Whether or not it is so in Germany, the process described by Herr Siemens in his English specification certainly keeps clear of the "claim" put forward by M. Royer de la Bastie, for he does not employ the method of hardening glass by plunging it when heated into a liquid bath at a lower temperature, but hardens the glass by placing it in moulds and pressing it at the same time. It was obvious at the time when M. Bastie's process was made public that great if not insuperable difficulty would be experienced in getting the glass to retain its shape during the hardening operations, especially so with articles that required to be shapely to be of any value at all. Whether these difficulties have been overcome we are not informed, and as there are already several patents relating to hardened or so-called unbreakable glass in the field, unless M. de la Bastie speedily occupies a position in the market he may find himself forestalled. At any rate it is asserted that the process patented by Herr Siemens effects all that could be done by M. de la Bastie's, and more, for the shape of the articles, can be easily preserved uninjured. It consists in a method of heating and then suddenly cooling the glass to be hardened or tempered; but when the articles are such as are usually moulded, the hardening and tempering are accomplished at the same time as the pressing—*e. g.*, the molten glass is run into suitable moulds and while still highly heated is squeezed, the moulds having the effect of giving the necessary cooling without resorting to the liquid bath of M. Bastie. The material employed for the moulds depends on the nature and thickness of the glass; in cases where the cooling process must necessarily be a rapid one, metals of good conducting power, such as copper, are preferred, while in those where the cooling has to be effected more gradually moulds of earthenware, or other bad conductors of heat are employed. In cases where the glass articles to be operated upon vary in thickness the conductivity of the parts of the moulds is varied accordingly, either by means of thicker metal near the thicker parts of the glass, or by making those parts of the mould of a better conducting material than the parts next the thinner portions of the glass. The moulds, too, must be kept at certain temperatures varying according as the nature of the glass requires that they should be cooled to a greater or lesser degree. In ordinary practice, however, it is found that cast-iron moulds maintained at a temperature of boiling water or thereabouts, and earthenware moulds kept quite cool, yield very satisfactory results. The liquid glass may be conveyed direct into the moulds, or may be taken from the melting-furnace on the blower's pipe and shaped in the mould, but it is preferable to heat the articles after shaping or partial shaping before pressing and cooling them. This part of the process introduces the difficulty of keeping the articles in shape, and it is overcome by Herr Siemens by means of casings or shells of platinum, such shells being transferred to the mould with the glass to undergo the pressing and hardening process. The heating ovens may be of any suitable construction, but Herr Siemens prefers to employ regenerative gas muffle ovens, heated under the floors and over the crowns by the flames of gas and air, which pass from one set of regenerators to another, which latter becoming sufficiently heated the currents are reversed in the well-known manner of alternated working; The muffle being completely closed in, the articles are protected from dust and other impurities which in the open furnace are apt to settle on and damage the surface of the glass.

The lower halves of the moulds are mounted on trucks or hand carriages, and are run up to the furnace mouth or the oven, as the case may be, and having received the glass are run under the respective upper halves, which may be loaded to give the desired pressure. The temperature of the moulds is kept at the required point by supplying them with liquid, and water at the boiling point is found to be well suited for the purpose. Herr Siemens claims the process described of producing hard pressed glass by treating it whilst heated in moulds at a lower temperature, whereby it is simultaneously compressed and hardened. He also claims the use of moulds having parts of varying thickness, or of different materials having various degrees of conductivity. A separate claim is also made for the use of the platinum moulds to maintain the articles in shape whilst being heated in the muffle. Whether the process of M. de la Bastie or that of Herr Siemens yields the best results no evidence is at present forthcoming, but there can be no question that a large demand will arise for unbreakable glass as soon as it can be supplied.—*Van Nostrand's.*

Divison of an Acid among Several Bases.

M. Berthelot has endeavored to solve the question whether, if an acid is present with several bases, it will unite with one, or be divided among them. Berthollet believed that each base would take an amount of the acid determined by its capacity for saturation and its quantity; for equal weights that each body would take an amount inversely as its equivalent; or, if the bases were employed in amounts proportional to their atomic weights, each would take half the acid. Gay Lussac believed that a complete mixture took place, and that the salts were formed only when separated by their insolubility, crystallization, or volatility.

To test these views, two bases were selected which disengaged an unequal amount of heat in uniting with the same acid. Thus mixtures of equivalent weights of chloride of ammonium and caustic soda were mixed. The difference in this case of the two bases would equal 1·12 units of heat. Were the theory of Berthelot correct, half of the acid should go to the soda setting free ·56 units of heat. Other divisions of the acid might set free any quantity from 0 to 1·12. According to Gay Lussac there should be no generation of heat, or at least the amount should be uncertain. Finally, if all the acid passed over to the soda, the amount of heat set free should be 1·12. The amount actually observed equalled 1·07, which as the probable error is ·04. evidently sensibly equals 1·12. The very small difference of ·05 is also explained by the purely physical action exercised by ammonia on a solution of chloride of sodium. In fact a mixture of the same quantities of ammonia water and chloride of sodium absorbs ·05 units of heat. Similar effects are also obtained by replacing the chloride by the nitrate or sulphate, or by using potash instead of soda. Not only can ammonia be replaced by soluble bases such as potash or soda, but even by those which are insoluble, such as lime.

According to Berthollet there should be a division at first, then a precipitation of the lime, and so on until it was wholly separated. But this effect is not produced, the lime is not precipitated but dissolved in the chloride of ammonium. To determine the reanature of the reaction a certain amount of lime was precipitated from the chloride by soda; 1·18 units of heat were thus absorbed. It was then dissolved by chloride of ammonia when 2·24 units of heat were disengaged. But in the latter operation the solution of the hydrate of lime by the ammonia should give out 1 10 units of heat; and the redissolving of the lime should give out 1·10, or in all 2·20, which agrees closely with 2·24, the observed amount. Again, the total heat set free, —1·18+2·24=1·06 is very nearly equal to 1·07, the amount set free in the previous experiment by the direct action of the soda on the chloride of ammonia.

These facts and measures prove that the double salts and the change of the solvent are not the cause of the phenomena; while they are completely explained by the complete substitution of the lime, a nearly insoluble base, by the ammonia, a soluble base. We see therefore that this substitution may take place contrary to the laws of Berthollet.—*Ann. Chim. et Phys.*, vi, 662.

Franklin Institute Reception Room at the Centennial.

The Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, through the kindness of the Centennial Commissioners, has opened a

A RECEPTION ROOM,

at the north western end of Machinery Hall, for the use of its members and visitors from abroad, interested in the Mechanic Arts. The Institute cordially invites all who desire to do so, to visit their room, in which will be found files of the Journal of the Institute and other periodicals devoted to the Industrial Arts. The room is in charge of a committee of thirty members of the Institute, one or more of whom will be in attendance daily, during the Exhibition, to receive visitors and give any information they may desire in reference to the Exhibition.

The following objects of great historical interest have been placed in the room:

1st. *Franklin's Electrical Machine.*—This instrument is doubtless the one used by the great philosopher in making his wonderful experiments in the science of electricity. Presented to the Institute by Dr. John R. Coxe.

2d. *Oliver Evans' Steam Locomotive Engine.*—This interesting model is among the earliest known, having been built about 1804.

3d. *Oliver Evans' High Pressure Steam E* .—This is the model of an engine built by O. Evans, about 1804, and is described in Galloway's work on the steam engine, page 101.—London, 1827.

4th. *Working Model of a Steam Engine* built by M. W. Baldwin, and presented by him to the Institute, about 1832.

THE AMERICAN GAS-LIGHT JOURNAL AND CHEMICAL REPERTORY

A. M. CALLENDER & CO.,

PROPRIETORS.

Editor—G. WARREN DRESSER.

PUBLISHED ON THE 2ND AND 16TH OF EACH MONTH

At No. 42 Pine Street, New York.

This is a recognized official organ of—
LIGHT, HEAT, MINING INTERESTS, STEAM, WATER-SUPPLY, PATENTED INVENTIONS, VENTILATION, SANITARY IMPOVEMENT, AND GENERAL CHEMICAL SCIENCE.

TERMS

SUBSCRIPTION—Three Dollars per annum, in advance.

AGENTS

NEW YORK—AMERICAN NEWS COMPANY, 119 and 121 Nassau St
BOSTON—S. M. PETTENGILL & Co., 6 State Street.
PHILADELPHIA—COE, WETHERILL & Co., Ledger Buildings, Phila.
Germany—B. WESTERMANN & Co., of New York.

MONDAY, JULY 17, 1876.

The Meeting of the Mining Engineers.

One of the benefits of the International Exhibition is the assembly of specialists of all nationalities, and in no branch of business is there a more noted congress than in that which treats of the mining, production and refining of the useful metals and of fuels. On Monday last the American Institute of Mining Engineers assembled in Philadelphia, having adjourned to that place from Washington last February, and active preparations for the meeting, under direction of an efficient committee of arrangements, have been in progress for weeks. A large proportion of the six hundred members of the Institute are in attendance, and many distinguished foreign engineers and scientists add interest to the session, some of them taking part in the discussions.

On Monday evening the members of the Civil Engineers' Society and the Institute of Mining Engineers held a joint discussion in the hall of the Franklin Institute, which was continued during Tuesday. Quite a number of prominent Americans and foreigners participated. Among the latter may be named two eminent English gentlemen, Sir John Hawkshaw and Sir Charles Reade, who gave up his seat in Parliament to attend to educational interests in England. This is without doubt one of the most interesting discussions of the year, and we earnestly hope that from it may emanate an impulse which will greatly benefit the educational interests of the world. The prominence given to the subject of education, and the liberal contributions made upon it to the International Exhibition, is a matter of satisfaction, and this discussion will ably second the attempt to direct public attention to the all important subject.

On the evening of Tuesday, June 20th, the regular session of the American Institute of Mining Engineers commenced. Mr. F. B, Gowen, president of the Philadelphia and Reading Railroad Company delivered the address of welcome, followed by an interesting inaugural address from the president elect, Hon. A. S. Hewitt, of this city.

The sessions of the Institute will cover eight or ten days, and include reading of papers, excursions and business meetings. Among the foreigners who are expected to participate are Sir Redmond Barry, of Victoria; Dr. Wedding, of Germany; Ernst Von Poutzen, of Austria; J. Beco and Julian Deby, of Belgium; Prof. Richard Akerman, of Sweden; Mr. I. Lowthian Bell, of England, to whom our metallurgists are indebted for his exhaustive inquiries, reads a paper upon the influence of hot blast. We doubt if America has ever seen such a gathering of geologists, analytical chemists, mining engineers, and those interested in the production and purification of useful metals, as are assembled in Philadelphia.—*Iron Age*, xvii., 25.

Engineering History of the Country.

The following is a synopsis of a very interesting paper read at the annual meeting of the American Society of Civil Engineers, held in Philadelphia last week, by Mr. Theodore G. Ellis, of Hartford, vice-president:

Washington was the first civil engineer of which the speaker had found any record. He gave some attention to canals, and was afterward on a commission for improving the navigation of the Potomac. The year 1787 was a date of great interest to the profession. In that year, John Fitch, a Philadelphian, built the first steamboat, and there is every reason to believe that when he built it he was ignorant of Watt's improvements. He built the first propellor ever constructed in 1796; in 1798 he built the first steamboat for carrying passengers, and in 1799 ran it on the Delaware, between Philadelphia and Burlington. In 1804 Oliver Evans, of Philadelphia, constructed the first machine for building docks—a heavy, flat-bottom boat, with a chain and buckets to clear out the mud. It had wheels for land and a stern wheel to propel it in the water. It seems to have been the archetype of stern wheel boats. At this time stage coaches had not come into use. In 1807 Robert Folton built his steamboat, and in 1811 he and Mr. Stephenson built a stern wheol boat at Pittsburgh, with which a voyage was made to New Orleans in 14 days. This was the first steamboat on Western waters.

The introduction of stage coaches produced a demand for bridges across the larger streams, and here was a fine field for engineering talent. Among these early structures was the magnificent 340 feet span over the Schuylkill, built in 1812 and burned in 1838. Travel between New York and Philadelphia a century ago can be estimated from the advertisements in the daily prints of that day, naming the time at which a stage coach would leave for New York twice a week. On the celebration of the semi-Centennial anniversary it was recorded as a matter of great wonderment that as many as 300 New Yorkers were in Philadelphia. In 1823 the Champlain Canal was finished, and several others were in progress. About this time the evidences of progress in civil engineering began to multiply, railroads were first talked of, and there were few to prophesy what should result from their introduction. In fact, it was authoritatively stated that the claim that locomotives would some day travel 12 miles an hour was bringing ridicule and harm to the whole project.

The first locomotive run in this country was built in England and was called the Lion. The first built in this country was constructed on West street, New York, in 1829. It was a four wheeler with upright boiler, and was built for the South Carolina road. Baldwin commenced to build engines in 1833. The first iron railroad bridge consisted of three spans 55 feet long for the Baltimore and Susquehanna Railroad Company in 1846, built by James Mulholland. Iron suspension bridges were previously used in 1796, over Jacob's Creek, Virginia, built by Mr. Finley. Iron bridges, however, did not come into general use until just before the civil war.

In fact, in the short space of a century, American engineering has sprung from obscurity to be equal to any in the world. We have the longest bridges, with the greatest span and deepest foundations, and the only railway suspension bridge in the world; the longest railways, the best equipped, and supplied with the most comfortable conveniences. It is idle to prophesy where another century's progress may find it. The day will come when men will smile at iron bridges when a lighter, stronger and more abundant metal will supplant iron. In aluminum is found lightness combined with strength, the only drawback to its use being the expense of extracting it from its combinations. It is not too much to expect to see bridges of a mile span made out of this metal.

It is peculiarly appropriate that the convention should meet in Philadelphia on this Centennial year, for it is well known to most of ths members that the science of engineering in this country commenced in Philadelphia, and many of the great inventions which gave an impetus to it can be traced directly to that city.—*Iron Age*, xvii., 26.

Sanitary Carbon.

Some interesting experiments were made on the 12th ult. at Campbell's Sewage Works, Wadsworth Road, London, with a new substance, which is practically animal charcoal, and which will probably find extensive use at no distant date in purifying the effluent water of districts that treat their sewage by precipitation, in clarifying the waste water of dye works and mines, and the thousand and one other ways that will suggest themselves at once to persons conversant with sanitary matters. It is the product of a company that owns some 1200 acres of the district on the Dorsetshire coast where the famous Kimmeridge shale deposit is found. This is a deposit which is of undoubted animal origin, and is supposed to consist of blubber fish and other forms of marine animal life. However this may be, the shale is found to yield more plentifully than cannel coal, and at less expense, an excellent carbon, one ton of the shale, after giving off 9,000 cubic feet of gas, leaving 11·6 cwt. of residue, which is the sanitary carbon in question. This substance is found to have precisely the same properties and action for all sanitary purposes as animal charcoal that costs from £14 to £18 per ton, and the company hope to be able to produce it for one-fourth the price. The experiments adverted to consisted in running sewage through a layer of the sanitary carbon, when the effluent water came out as clear as crystal. A more crucial trial still was made by mixing sewage with a compound of ink dye stuffs in solution, forming a liquid more intractable than would ever be met with in actual drainage operations; but the result was the same, the water running off perfectly clear, with no perceptible odor.—*British Trade Journal*, *June* 1.

Price of Gas.

The following prices are *official*, having been furnished to the AMERICAN GAS-LIGHT JOURNAL by the officers of the various Gas Companies.

Albany (Peoples) N. Y.	$2.75	
Annapolis, Md.	3.40	
Atchison, Kansas.	4.50	
Austin, Texas.	6.00	
Allegheny City, Pa.	1.80	20 p. ct. off prompt pay
Albany, N. Y.	2.75	
Ashland, Ohio.	3.50	Street lamps 4½ hours 17 nights per month $15 per annum.
Augusta, Ga.	4.00	Net.
Anderson, Ind.	3.50	Crude petroleum.
Ashtabula, Ohio.	2.00	Wren's process; $10 for 80 candle gas.
Auburn, N Y.	3.50	5 p c off prompt pay.
Allentown, Pa.	2.50	$18 per an street lamps Meter rent 10 cents per month.
Ashland, Pa.	10.00	70 candle gas, 10 p c off prompt pay. Patton's process.
Brooklyn, B'klyn.	2.75	
" Citizens.	2.75	
" Nassau.	2.75	
" Metropol'an	2.75	
" Peoples.	2.75	
" W'msburgh	2.75	
Brockton, Mass.	3.80	
Batavia, N. Y.	3.00	
Bridgton, N. J.	3.50	

Bangor, Me	3.00	
Boonville, Mo	4.50	
Brownsville, Tenn	4.50	
Belfast, Maine	4.00	10 p. c. off bills over $10; 5 p. c. off bills under $10.
Brockville, Ontario	3.75	
Bloomfield, N. J	3.75	
Belleville, Ill	3.50	
Bellaire, Ohio	2.85	5 p ct. off prompt pay.
Barnesville, Ohio	3.00	5 p ct. off prompt pay. Street lamps $17.50 per ann. Burn till 12 P. M. on moonless nights.
Boston, Mass	2.25	
Bath, Maine	4.00	12½ p c off prompt pay.
Bayonne City, N. J	4.00	Net.
Binghampton, N. Y	4.00	10 p c off prompt pay on bills for 1000 per month.
Buffalo G L Co., N Y.	2.50	10 p c off prompt pay.
Buffalo Mutual, N Y	2.50	10 p c off prompt pay.
Buffalo Citizens, N Y.	2.50	10 p c off prompt pay.
Bloomsburg, Pa	10.00	70 candle gas, 10 p c off prompt pay. Patton's process.
Cleveland, Peoples, O	2.00	
Cumberland, Md	3.00	
Charleston, W. Va	4.00	25 p. ct. off prompt pay Meter rent 25, 30, and 50 cents. per m. for 3, 5 and 10 light.
Cincinnati, Ohio	2.25	
Columbia, Mo	4.50	
Carondolet, South St. Louis, Mo	3.00	5 p. ct. off prompt pay,
Chattanooga, Tenn	3.00	
Cold Water, Mich	3.25	
Chicago, Ill	2.50	
Columbia, Pa	2.85	Lowe process.
Charlottesville, Va	2.50	Meter rent 20 cents.
Cedar Rapids, Iowa	4.50	50 cts p M. off prompt pay.
Cairo, Ill	3.75	50 cts added if not paid by the 5th.
Cortland, N. Y	4.00	25 cts p M. off prompt pay.
Cairo, Ill	3.75	50 cents per month off prompt pay. For 20,000 feet a month $2.50.
Chillicothe, Ohio	3.00	
Camden, N. J	3.16	5 p c off prompt pay; 10 p c off for 100,000 per year.
Carson City, Nevada	8.00	Gas from wood and Cannel coal.
Cadiz, Ohio	3.50	10 p c off on 500 feet or less; 50 cts per M. on from 500 to 2000; 20 p c off on 2000 and upwards.
Derby, Conn	3.60	10 p. c. off prompt pay, and 50 cts per M. on excess of 5000 ft. per month.
Decatur, Ill	3.50	50 cts. per M. added, if not paid by 10th.
Danbury, Conn	4.28	For less than 5000 per month.
" "	3.85	For over 5000 per m th
Dover, Del	3.60	
Dunkirk, N Y	2.50	Street lamps till 12, moonless nights $25 per annum.
Defiance, Ohio	10.00	70 candle gas, 20 p c off prompt pay. Patton's process.
East Boston, Mass	3.00	
East St. Louis, Ill	3.50	5 p. c. off prompt pay.
Evansville, Ind	3.00	City lamps $30.
Erie, Pa	3.00	City lamps $28 p. an.
Elkhart, Ind	3.50	
East Newark, N. J	4 00	
Eastchester, N. Y	3.50	
Elizabethtown, N. J	3.00	
East N Y (Union) L I.	3.00	
Eastport, Me	4.00	
Fredericksburg, Va	3.40	
Flint, Mich	3.50	
Franklin, Pa	3.00	
Fall River, Mass	3.00	
Freeport, Ill	3.80	
Fort Scott, Kansas	4.50	
Flatbush, L. I	3.50	
Fredonia, N. Y	3.00	Street lamps $25 per annum; burn fill 12 P. M.
Guelph, Ontario	3,50	
Geneva, N, Y	2.50	5 p. c. off prompt pay. Wood and oil gas.
Greensboro, N. C	4.00	
Galena, Ill	4.50	Meter rent 25 cts. per month.
" "	4.00	After September 1st.
Grand Rapids, Mch	2.80	For less than 1000 feet per month.
" " "	2.50	For over 1000 eet per month. 10 per ct discount on 300,000 ft annually
Gloucester, N. J	3.15	5 p c off prompt pay.
Greenwich, Conn	2.40	Wren's process
Goshen, Ind	10.00	70 candle gas, 20 p c off prompt pay. Patton's process.
Huntsville, Ala	3.50	
Hempstead, L. I	4.00	
Huntingdon, Pa	3.80	10 per ct. off prompt pay.
Hagerstown, Md	3.75	
Hamilton, Ohio	4.00	
Hillsdale, Mich	3.50	
Holyoke, Mass	3.01	
Hartford, Conn	2.75	
Hornellsville, N. Y	3.50	50 cents per 1000 off prompt pay.
Honesdale, Pa	4.00	12½ cents meter rent per month.
Hannibal, Mo	3.00	No meter rent.
Ithaca, N. Y	4.00	5 p. c. off prompt pay.
Indianapolis, Ind	2 50	
Indiana, Pa	3.00	10 p. c. off prom pay Meter rent 50 cents per month.
Jersey City, N. J	2.75	
Joliet, Ill	3.50	
Jacksonville, Ill	4.00	12½ p.c. off prompt pay.
Jefferson City, New Orleans, La	4.00	
Johnstown, N Y	3.50	
Knoxville, Tenn	3.00	Meter rent 15 cents.
Lyons, N. Y	4.00	
Lima, Ohio	3.80	
Lynchburgh, Va	3.00	5 p. ct. added to bills not paid in 5 days.
Louisiana, Mo	4.50	
La Crosse, Wis	4.50	50 cents per M. off prompt pay.
Lancaster, Pa	3.00	
Louisville, Ky	2.70	5 p. c. off prompt pay.
La Porte, Ind	3.50	Wood and oil gas.
Lowell, Mass	2.50	25 cents per 1000 off prompt pay.
Lafayette, Ind	2.75	
Lexington, Mass	2-40	Wren's process.
Los Angelos, Cal	6.00	
Millville, N. J	3.12	
Milford, Del	3-50	
Marquette, Mich	3.50	
Morris, Ill	2.00	For 15 candle power, or $10 per M. coal gas meter measure (Petroleum Gas—Wren's patent).
Meriden, Conn	3.93	
Marietta, Ohio	3.50	20 cts. per M. off if paid by 6th. Consumers over 3000 ft. 30 cts. additional disconnt.
Marshalltown, Iowa	4.50	50 cts p M. off prompt pay.
Meadville, Pa	3.50	25 cts p M. off prompt pay.
" "	2.50	For over 10,000 ft. per month,
Madison, Ind	3.75	25 p c off if paid in five days: 25 to 40 cents per month meter rent.
Monroe, Mich	3.50	5 per ct off prompt pay
Malone, N. Y	4.50	
Middletown, Conn	3.56	Net.
Mount Sterling, Ky	4.50	
Monongahela, Pa	2.75	Under 5000 feet m'th $2.75 per M.; over 5000 feet per month $2.50 per M.
Minneapolis, Minn	5.00	10 p c off prompt pay.
Mahanoy City, Pa	10.00	70 candle; 20 p c off prompt pay. Patton's process
Morristown, Pa	3.00	18 candle coal, an
New York, New York	2.50	
" " Harlem	2.75	
" " Manhattan	2.50	
" " Mutual	2.50	
" " Mropolitan	2.50	
" " Municipal	2.50	Water Gas.
Nashville, Tenn	2.85	
Newark, Citizens, N.J.	2.85	
Norfolk, Va	3.10	
New Brunswick, N. J.	2.70	
Newton, N. J	4.00	
North Attleboro, Mass.	3.50	
New Britain, Conn	3.70	
New Haven, Conn	2.75	
Nantucket, Mass	3.00	Meter rent 15 cts. p. m.
Newark, N. J	2.85	
Niagara Falls, N. Y	3.50	20 cts p M. off prompt pay.
Norwalk, Conn.	4.00	12½ p ct off prompt pay.
New Albany, Ind	3.00	
New City, Montreal	2.50	Street lamps, $22 p an
Oswego N. Y	3.15	5 p. c. off prompt pay.
Ottawa,, Ill	4.00	12½ p. c. off promptpay
Omaha, Nebraska	5.00	
P'keepsie, Citizens	2.70	Gwynne Harris process
Paterson, N. J	3.80	10 p c. off prompt pay, and in addition 5 p.c. on bills of $300; 10 p. c. on bills of $1000
Portchester, N. Y	3.50	
Pittsfield, Mass	3.50	5 p. c. off prompt pay, and 10 p. c. off on bills of $350 per an
Portland, Me	3.00	
Paris, Ky	4.50	Meter rent 25 cts. p m.
Portsmouth, N. H	3.22	
Pittsburgh, Pa	1.00	
Philadelphia, Pa	2.15	
Painesville, Ohio	3.50	
Pawtucket, R. I	2.80	5 p c allowed on bills of $500, and 10 p c on bills of $1500 for six months.
Providence, R. I	2.25	
Pottsville, Pa	3.50	10 p ct off prompt pay.
Plainfield, N. J	3.50	5 p ct off for less than 5000 a month. 10 per cent more than 5000 a month.
Peoria, Ill	3.50	
Paducah, Ky	4.00	10 p c off prompt pay.
Plymouth, Pa	10.00	70 candle. Patton's process.
Pottstown, Pa	3.20	Public lamps till 11 P. M., 18 nights per month $20 per lamp.
Poughkeepsie, N Y	2.60	10 p c off prompt pay.
Port Huron, Mich	3.50	
Quincy, Citizens, Mass.	5.00	
Quincy, Ill	3.50	
Quebec, Ont	2.40	
Rome, N. Y	3.60	
Rochester, N. Y	3.00	
" Citixens	3.00	
Rondout, N. Y	3.60	
Rockford, Ill	4.00	5 p c off prompt pay; 10 to 25 p c off on bills for 500 to 25 M, feet per month.
Richmond, Ind	3.00	50 cents added if not paid by 20th.
Syracuse, N. Y	2.75	
Springfield, Ill	3.25	$25 for city lamps.
St. Joseph, Mo	4.00	12½ p. ct. off on bills over $100 p. month.
St. Albans, Vt	5.00	10 p. c. off prompt pay, and in addition 5 p. c. off bills from $50 to $100 per month; 10 per. ct. off bills over $100.
Sandusky, Ohio	3.00	
Saratoga, N. Y	5.00	20 p. c. off prompt pay, Nov. 1st to May 1st. 10 p. c. rest of year.
San Antonio, Texas	7.00	10 per ct off from 10 to 20,000 per month 20 p ct off from 20,000 and upwards.
St. Charles, Mo	4.50	
Sidney, Ohio	3.25	
Steubenville, Ohio	2.50	
Sherman, Texas	5.00	5, 10, 15 and 20 p. c. off, according to quantity.
Salem, Oregon	7.00	October last reduced from $8.
Salem, Ohio	2.75	Meter rent 12½ cts if 300 feet is not used monthly
Sedalia, Mo	3.50	
Sharon, Pa	3.15	5 per ct off on less than 5000 feet per month. 10 p ct from 5 to 15 M. 15 p ct from 15 to 20 M. 20 per ct over 40 M.
Shreveport, La	5.00	
Shelbyville, Ind	2.00	Wren's process; $10 for 80 candle gas.
Shenandoah, Pa	10·00	70 candle. Patton's process.
Shamokin. Pa	10.00	70 candle. Patton

Sunbury, Pa.	10.00	70 candle. Patton's process.
Tiffin, Ohio.	3.00	
Titusville, Pa.	3.00	
Tidioute, Pa.	2.00	Wren's process.
Vicksburgh, Miss.	4.50	
Wilkesbarre, Pa.	3 50	10 p. c. off prompt pay.
Worcester, Mass.	3.00	5 p. c. off on $500, and 10 p. c. off on $1000 in six months.
Westfield, N. Y.	4.00	10 p. c. off prompt pay.
Washington, D. C.	2.25	
Watertown, N. Y.	4.50	10 p. c. off prompt pay.
Wheeling, West Va.	2.25	10 p ct off prompt pay.
Washington, Pa.	2.50	
Woburn, Mass.	3.00	
Waterbury, Conn.	3.50	5 p c off on biils of $50 10 p c off on bills of $100. 5 p c added if not paid by 10th.
York, Pa.	3.00	Meter rent 12½ cents.
Youngstown, Ohio	2.50	10 p. c. off on bills of $50 per month.
Waterbury, Conn.	3.00	5 p c off on bills of $50, 10 p c off on bills of $100; 10 p c added if not paid by 10th.
Washington, C H., O.	1.20	Wren's process; $6 for 80 candle gas.
Wilmington, Del.	2.50	Street lamps 3,650 hrs per year, $31.50 per lamp.
Zanesville, Ohio.	2.70	10 p. c. off on bills of $25 per month; city lamps $23.

Gas Stocks.

Quotations by W. H. Scott & Co., Bankers,

24 Pine Street, New York City.

July 3, 1876.

☞ All communications will receive particular attention

	Capital.	Par.	Bid.	Asked.
Gas. Co.'s of N. Y. City.				
Harlem	$1,850,000	50	120	122
Manhattan	4,000,000	50	235	240
Metropolitan	2,500,000	100	145	150
" Scrip	$1,000,000	..	102	—
" Bonds..	500.000	1000	104	—
Mutual	5,000,000	100	115	—
" Bonds, gold.	900,000	1000	105	—
New York	4,000,000	100	130	135
Central, Westchester	466,000	50	100	105
Gas Co.'s of Brooklyn.				
Brooklyn	2,000,000	25	190	195
Citizens	1,200,000	20	85	87
" Scrip	320,000	1000	95	100
Peoples	1,000,000	10	50	55
" Bonds.	$ 325,000	...	—	95
" Scrip	300,000	...	85	—
Metropolitan	1,000,000	100	70	78
Nassau	1,000,000	25	75	80
" Ctfs.	700,000	1000	96	98
Williamsburgh	1,000,000	50	125	130
" Scrip		...	100	103
Out of Town Gas Companies.				
Bath, Maine	70,000	100		
Buffalo Mutual, N. Y	750,000	100	—	80
" Bonds	200,000	1000	—	90
Baltimore, Md.	2,000,000	100	165	180
" Ctfs., gold	1,000,000		105	—
Bayonne, N. J.		100		90
Brockport, N. Y.	25,000	100	...	80
Citizens, Newark.	918,000	50	87½	—
" " Ctfs.	53,000	—	—	—
" " Bds.	124,000	—	—	—
Derby of Conn	160,000	100	60	80
East Boston, Mass.		25	132	—
Fort Wayne, Ind.		100	...	—
Hannibal, Mo.	100,000	100	95	100
Hartford, Conn.	700,000	25	152	—
Hempstead, L	25,000	100	...	—
Jersey City	386,000	20	160	170
Jamaica, L. I.	25,000	100	...	—
Jacksonville, Ill.	120,000	50	82	...
Lewistown, Maine	400,000	100	50	85
Lima, Ohio	60,000	100	85	...
" Bonds	30,000			
Laclede, St Louis Mo	1,200,000	100	—	105
Peoples, Jersey City		...	125	135
Peoples of Albany	650,000	100	—	25
" Bonds	350,000	1000	—	—
Peoples of Baltimore		25	101	102
" Bonds			106	—
Perth Amboy		25	—	95
Rochester, N. Y.		100	50	60
Richmond Co., S. I.	300,000	...	100	105
Woonsocket, R. I.	150,000	100	100	...
Halifax N. S.	400,000	40	148	150
Hamilton, Ontario	150,000	40	112½	
San Francisco Gas-Co., S. Fr'isco Cal.			99	100
St. Louis, Missouri	600,000	50	110	130
Stillwater, Minn.	50,000	50	—	26
Suburban, W'stch'str	390,000	50	—	100
Saugerties, N. Y.	15,000	100	100	110
Troy, Citizens	600,000	100	—	100

250 shares of Brooklyn Gas Co's stock sold at auction @ 183—185.

The New Bedford Gas Co. have declared their semi-annual dividend of 4%. The Laclede Gas Co., of St. Louis, Mo., have declared their regular semi-annual dividend of 5 %, payable July 15th.

PRICES OF FOREIGN AND DOMESTIC GAS COALS.

[Reported Expressly for this Journal.]

July 17, 1876.

DELIVERED IN NEW YORK.

English Cannel.			
Ince Hall	$17 00	@	18 00
Kirkless Hall	16 50	@	17 00
English Caking Coals.			
Newcastle Gas	$5 50	@	00 00
Liverpool caking	11 50	@	12 00
British Province Coals.			
Pictou			2 00
Block House—At Mines, $1.87, Gold			2 00
Caledonia—At Mines, $1.50, Gold			0 00
Little Glace Bay—At Mines, $1.75, Gold			0 00
Lingan—At Mines, $1.75, Gold			0 00
Sydney—Old Mine			3 00
" Reserve, $1.75, Gold Mine			0 00
" International			— —

Duty, 75 cents per ton, gold. Freight to New York $2 00 currency. Cost of above coals delivered in New York, $4 75 @ $5 00, currency.)

Pennsylvania Coals.			
Penn Gas Coal—At Amoy	$5 60	@	0 00
Westmoreland—At Amboy	5 60	@	0 00
Shafton	5 60	@	0 00
(In New York, the above coals $6 00)			
Youghiogheny	6 00	@	0 00
Waverly	6 00	@	0 00
West Virginia Coals.			
Murphy Run	6 50	@	0 00
Despard	6 50	@	0 00
West Fairmont	6 50	@	0 00
American Gas Coal	7 40	@	0 00
Fairmont	6 50	@	0 00
Newburgh Orrel	6 50	@	0 00
Pinnickinick	6 50	@	0 00
Cloverhill of Virginia	6 00	@	6 50
McKenzie Compound Mixture			— —
American Cannel Coals.			
Peytona of West Virginia	$12 50	@	00 00
Darlington of Pennsylvania			— —
Cannelton Cannel			11 00
Red Bank—at Philadelphia			6 50
" —at South Amboy			7 25
Asphalts.			
Albertite of New Brunswick	$21 00	@	— 00
Trinidad Bitumen	— —	@	14 00

The Penn Gas Coal Company have contracted with the Pittsburgh Gas-Light Co. for their entire supply for the ensuing year from their Youghiogheny mines.

Within the last week contracts have been made by some of the companies in New York for about 200,000 tons of Penn Westmoreland, Waverly, Youghiogheny, and the West Virginia caking coals—at $6 00 per ton a reduction of 50 cents from last years' prices.

JAMES MARSHALL & CO.

Franklin Foundry and Pipe Works,

MANUFACTURERS OF

GAS, WATER, AND OIL PIPES,

Works, 18th, 19th, 20th and Railroad Street. Office, No. 23 Nineteenth Street.

Pittsburgh, Pa.

Pipes from 3-inch and upwards cast in 12 ft. lengths.

☞ Send for Circular and Price List

WANTED.

A COPY OF

SUGG'S GAS MANIPULATION,

Edition 1867. Address American Gas-Light Journal, stating price, etc.

GAS COMPANIES, CITY GOVERNMENTS. MEN OF SCIENUE,

AND THOSE INTERESTED IN

Lighting Streets, Hotels, Churches, Bridges, Parks, Public Buildings, Etc.,

will find it to their interest to examine the greatest, and we might say the only improvement in Street Lamps since the Pantheon was built. Some trifling changes have been made in the form of Street Lamps, which has improved their appearance, or some more convenient method of fastening a door or hanging a lamp has been invented. But up to this time no improvement in its illuminating capacity or general utility has been made. We now have an improvement not merely in its appearance, but in its essential elements of value, illuminating power, economy, and usefulness, and we solicit the most critical examination of men of scientific knowledge, as well as all who are interested in obtaining the most economical, efficient, and beautiful Street Lamps ever produced, we challenge the world to produce its equal.

It is DYOTT'S PATENT CHAMPION STREET LAMP which we are prepared to demonstrate, possessing the following advantages over every other Lamp: First. It will give *double the light* of any other Lamp with the same quantity of gas consumed in it. Second. It will cost 75 per cent. less per annum than others to keep it sound and in good repair. Third. It can be cleaned and kept as handsome as when new, with half the labor required by others. Fourth. It is the handsomest, the most efficient, the most durable, and the cheapest Lamp in existence. It is screwed, bolted or riveted together, and not a particle of tin or solder is used in its construction. It has been selected and purchased by the U. S Patent Office and the U. S. Post Office. Four of our beautiful five-light Clusters now light the entrances to the U. S. Patent Office. Six five-light Clusters and six of our Ornamental Lamps light the U. S. Post Office at Washington city. Four of our five-light Clusters have for the past two years lighted the entrance to the Baltimore & Potomac depot at Washington, D. C. Our champion Lamps adorn and light hundreds of the handsomest and most costly buildings in this and other countries.

They are extensively used in over 200 cities, and are largely in Canada, Russia, Barbadoes, South America and Australia. They have taken the first Premiums and highest award of every exhibition at which they have been presented. They are manufactured in the largest variety of Designs for single Posts, Brackets, Hanging and in Clusters of two, three, four, five, six and thirteen Lamps. The entrances to the main building of the Centennial Exhibition are lighted with 272 of our Patent Champion Lamps and Braekets of special design. We refer with pride to them. Our Lamps were purchased by the Building Committee, and are not to be taken back *as all others are* at the close of the exhibition.

We will send illustrated cuts, drawings and circulars, and will furnish designs for special purposes of Posts, Brackets and Lamps when written or called for and will take pleasure in answering any inquiries that may be made.

M. B. DYOTT,
114 South 2nd St., Philadelphia.

CATHELS'S

IMPROVED RETORT SETTINGS,

GUARANTEED TO HEAT UNIFORMLY WITH THE MINIMUM OF FUEL.

Colored lithograph copies of work'ng drawings of beds of 1, 2, 3, 5 6 and 7 retorts each, so clearly arranged and fully shown, as to be easily understood by any retort setter or bricklayer having just been made of these valuable settings, they can now be supplied, with detailed specifications immediate on receipt of orders.

Applications to be made to A. M. CALLENDER & CO. office o American Gas-Light Journal 42 Pine street New York. 403

NOTICE TO GAS COMPANIES.

WANTED—A SITUATION BY A YOUNG MAN, who has had upwards of Nine Years experience in Repairing and Fixing Gas Meters. Has had some experience in Gas Fitting, etc.; willing to make himself generally useful. Good references given. Address to C. McKAY, 342 Milwaukee street, Milwaukee, Wisconsin. 409-8t

FOR SALE,

A HALF INTEREST IN A SMALL GAS WORKS WILL be sold. or leased to a practical gas man. Two thousand feet of natural gas per day. Address

J. SHACKELTON,
405-tf Westfield, N. Y.

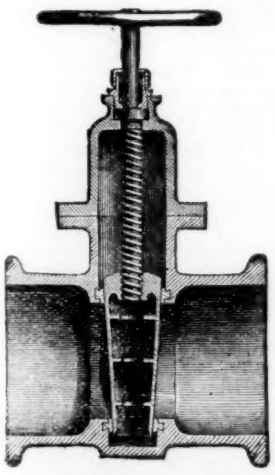
A COMPETENT PERSON DESIRES ENGAGEMENT AS Superintendent of Gas Works, where the make is 25,000 to 100,000 per diem. Address Superintendent, care T. A. Bate, Superintendent Gas Co., Evansville, Ind. 409-2

CHAPMAN VALVE MANUFACTURING CO.

MANUFACTURERS OF

CHAPMAN GAS VALVES.

Office and Sales Room 75 and 77 Kilby Street, Boston.



These Valves have been in use for several years, and are pronounced by all who have used them to be

The Best Gas Valves Ever Made.

They afford a direct passage the full size of the pipe. The seats are made of an alloy similar to BABBITT metal, specially prepared for the purpose, and superior to all other metals used for the seats of Gas Valves. It does not corrode under any circumstances to which it is exposed.

There is no LIABILITY OF COHESION between the Gate and Seat, and the Valves can be relied upon to SHUT TIGHT and OPEN EASILY at all times—an important desideratum when used for street mains, in cases of fire.

We refer to the following named Gas-Light Companies among the many that have used these Valves:

BOSTON GAS-LIGHT COMPANY, BOSTON, MASS.
CAMBRIDGE GAS-LIGHT COMPANY, CAMBRIDGE, MASS.
NEWTON & WATERTOWN GAS-LIGHT CO., WATERTOWN, MASS.
LAWRENCE GAS-LIGHT COMPANY, LAWRENCE, MASS.
PEOPLES GAS-LIGHT COMPANY, BROOKLYN, N. Y.
CITIZENS GAS-LIGHT COMPANY, BROOKLYN, N. Y.
SOUTH BOSTON GAS-LIGHT COMPANY, BOSTON, MASS.
CHARLESTOWN GAS-LIGHT CO., CHARLESTOWN, MASS.
LYNN GAS-LIGHT COMPANY, LYNN, MASS.
FITCHBURG GAS-LIGHT COMPANY, FITCHBURG, MASS.
CITIZENS GAS-LIGHT COMPANY, NEWARK, N. J.
WILLIAMSBURGH GAS-LIGHT CO., WIRLIAMSBURGH, N. Y.

GAS AND WATER VALVES ½ INCH TO 36 INCHES DIAMETER.
STEAM VALVES ½ INCH TO 12 INCHES DIAMETER.

357-tf

Advertisers Index.

GAS BURNERS, APPARATUS, ETC.

American Meter Co.—West 22nd st., N. Y., Arch and 22d st., Phil., 548 Washington st., Boston.
Cast Iron Gas and Water Pipe—S. Decatur Smith, York and Moyer streets, Phila., Pa.
Cast Iron Gas and Water Pipes—R. D. Wood & Co., Philadelphia Pa.
Cast Iron Gas and Water Pipe—McNeal & Archer, Burlington, N. J.
Clay Gas Retorts, etc.—Gardner Bros., 96½ Fourth Avenue, Pittsburgh, Pa.
Cast-Iron Pipes and Fittings—B. S. Benson, 52 East Monument street, Baltimore, Md.
Cast Iron Pipes for Water and Gas—Riley A. Brick, 112 Leonard street, N. Y.
Cast Iron Gas and Water Pipe, etc.—H. R. Smith & Co., Columbus, Ohio.
Gas Valves (Chapman) 75 and 77 Kilby st., Boston, Mass.
Gas-Burners—C. Gefrorer, 248 North 9th st., Phila., Pa.
Gas Purification—St. John and Cartwright, 21st and Avenue A, New York.
Gas Meters, etc.—Harris, Griffin & Co., 12th and Brown streets, Phila., Pa.
Gas Meters, etc.—Wm. W. Goodwin & Company, 1012 Filbert street, Phila, Pa.
as Meter Manufacturers—Harris, Helme & McIlhenny, 1117 Cherry st., Philadelphia, Pa
Gas Fixtures, Etc.—Mitchell, Vance & Co., 597 Broadway
Gasholders, Etc.—Delly & Fowler, 39 Laurel st., Phila., Pa.
Gas-Light Company of America, 63 and 64 Drexel Building, New York.
Gasholders—George Stacey & Co., Ramsay st., Cincinnati, O.
Lava Tips and Scotch Tips—Charles H. Meyer & Co., 227 Chestnut street, Phil. Pa.
Patent Conically Slotted Wood Trays—John L. Cheesman, 147 and 149 Avenue C., N. Y.
Patent Gas Exhauster—Smith & Sayre, 95 Liberty sttreet.
Pelouze & Audouin Condenser—Jas. R. Smedberg, Sole Agent for U. S. San Francisco, Cal.; Henry Cartwright, 2107 Green street, Phil. Pa.
Patent Gas Exhauster—S. S. Townsend, Agt., 31 Liberty street, N. Y.

GAS COALS

Cannelton Coal Co. of West Virginia—J. Tatnall Lea 325 Chestnut street, Phila, Pa.
Cannel Chips—H. E. Hoy, 34 New street, N. Y.
Despard Coal Co.—Parmelee & Bros. Agents 32 Pine st. New York.
Gas Coals—Perkins & Job, 27 South st. ,N. Y.
New York and Cleveland Gas Coa Company—384 Penn Avenue, Pittsburgh, Pa.
National Coal Gas Company—H. P. Allen, 4 Warren st., N.Y.
Penn Gas Coal Co.—11 Merchants' Exchange, Phil. and 90 Wall street, N. Y.
Peytona Cannel Coal—S. E. Low, 58 Broadway, N. Y.
Tyrconnell Gas Coal—52 S. Gay Street, Baltimore, Md.
Youghegheny Coal—Perkins & Job, 27 South St N. Y.
Scotch Cannel Coals—James McKenzie, Cannel Coal Merchant, Haymarket, Edinburgh.

FOUNDRIES.

Atlantic Dock Iron Works—John P. Kennedy, Office 98 Liberty street, N. Y. P. O. Box 2348.
Continental Works—T. F. Rowland, Greenpoint.
Camden Iron Works, Camden, N. J.—Jesse W. Starr & Son.
Franklin Foundry and Pipe Works—Jas. Marshall & Co., 23 Nineteenth street, Pittsburgh, Pa.
Gloucester Iron Works—J. P. Michelion, Sec., 6 North 7th street, Phila., Pa.
National Foundry and Pipe Works—Wm. Smith, Carroll, Pike, Smallman & Wilkins streets, Pittsburg, Pa.
Oregon Iron Foundry—Herring & Floyd, 740 Greenwich street, N. Y.
Pascal Iron Works—Morris, Taskar & Co., Philadelphia.

WATER METERS, PUMPS, ETC.

Valves for Water, Steam and Gas—Ludlow Valve Man'g Co., 940River street, Troy, N. Y.

CLAY RETORT WORKS.

B. Kreischer & Son, Clay Retorts, etc., 58 Goerck st., N. Y.
Cheltenham Fire Brick and Clay Retort Works—Evens & Howard, 916 Market street, St. Louis, Mo.
Clay Retort and Fire Brick Works—Edward D. White, Van Dyke street, Brooklyn, N. Y.
Manhattan Clay Retort Works, 15th st., near Av. C, N. Y.
Philadelphia Fire Brick Works, Vine and 23d sts., Phila,
Clay Gas Retorts, etc., etc.—J. H. Gautier & Co., cor Greene and Essex streets, Jersey City, N. J.

LAMPS, STOVES, PETROLEUM, ETC.

Lamps—M. B. Dyott, 114 South 2nd Street, Phil. Pa.
Patent Lamp Post—J. W. Graham, Chillicothe, Ohio, or A. M. Callender, office of this Journal.

MISCELLANEOUS.

Architect and General Gas Engineer—William Farmer, 61 Broadway Room 95, N. Y.
Brass Cocks, Plumbers' Materials, etc., etc.—McNab & Harlin Manufacturing Co., 56 John st., N. Y.
Contractors for Gas Works, Etc.—Murray & Baker, Fort Wayne, Ind.
Cathell's Improved Retort Settings—A. M. Callender & Co., 42 Pine street. N. Y.
Fodell's System of Bookeeping—A. M. Callender & Co., 42 Pine st., New York.
Lowe Gas Process—S. A. Stevens & Co., Sole Agents, Room 27. Astor House, N. Y.
Gas Engineer—B. E. Cholliar, 914 Olive St., St. Louis, Mo.
Kidd's Gas Consumers Guide—A. M. Callender & Co., 42 Pine Street, N. Y.
Portland Cements—S. L. Merchant & Co., 76 South st., N. Y.
Screening Shovels—Herring & Floyd, 740 Greenwich street New York.
Scientific and Practical Chemist and Geologist—Profetsor Henry Wurtz, 12 Hudson Terrace, N. J.
Screening Shovels—A. See & Son, 1258 Broadway, N. Y.
Screening Shovels—Torrance, Merriam & Co., Troy, N. Y.
Strap File and Binder—A. M. Callendar & Co., 42 Pine street, Room 18. N. Y.
nited States Hoisting and Conveying Company, 115 Broadway, N. Y.
Wren's Gas Works—Cor. Jay and Water sts., Brooklyn, N. Y.

JOHN P. KENNEDY,

SUCCESSOR TO

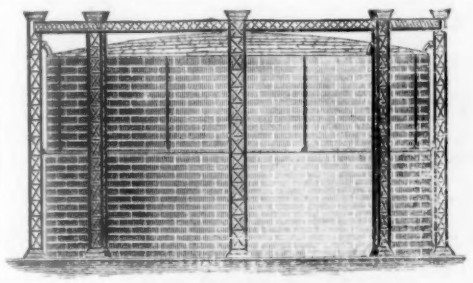
Hoy, Kennedy & Co.,

GAS ENGINEER AND CONTRACTOR

For the Erection, Alteration and Extension of Gas Works.

PLANS, SPECIFICATIONS AND ESTIMATES.

Office 111 Liberty Street. P. O. Box 2,348.



AGENT FOR THE

ATLANTIC DOCK

Iron & Machine Works,

FERRIS, WOLCOTT AND DYKEMAN STREETS,

South Brooklyn.

MANUFACTURERS of every kind of Gas Machinery, Retorts Bench Castings, Wrought Iron Work, Multitubular and Air Condensers, Washers, Scrubbers, Purifiers, Exhausters with every equipment complete for large or small Works,

GAS-HOLDERS,

TELESCOPIC OR SINGLE;

Iron Roof Frames with Cornice Gutters, covered with Corrugated Iron or Slate; Iron Doors and Iron Pivot Blind Windows; Coke Barrows, Fire Tools, Retort Lids, Cotter Bars and Screws, Stop Valves, Tar Valves for Regulating Dip in Hydraulic Mains, Pressure Governors for Street Mains, and Compensators for Exhausters that are unrivalled for unvarying accuracy Steam Engines, Boilers, Etc., Etc.

Post Office Box 2,348. Office 98 Liberty street.

GAS COALS.

THE
PENN GAS COAL COMPANY

OFFER THEIR

COAL, CAREFULLY SCREENED,

AND PREPARED FOR

GAS PURPOSES.

Their Property is located in the Youghiogheny Coal Basin, near Irwin's and Penn Station, on the Pennsylvania Railroad, and on the Youghiogheny River.

OFFICES

No. 11 Merchants Exchange, Phil'a. 90 Wall Street, New York.

PLACES OF SHIPMENT.

Pennsylvania Railroad, Pier No. 2 (Lower Side).
Greenwich Wharves, Delaware River.
366-1y **Pier No. 1 (Lower Side), South Amboy, N. J.**

CANNELTON COAL CO.

OF WEST VIRGINIA.

Offer for sale the following Coals, from their Colliery at CANNELTON, Kanawha County, West Virginia, delivered at RICHMOND, Va.:

CANNELTON CANNEL,

cknowledged to be the most valuable ENRICHER produced in this country, a gross ton yielding 10,000 ubic feet of GAS of 64·54 CANDLE POWER; COKE 32 bushels, of good quality.

CANNELTON CAKING COAL.

Volatile Matter.	Coke.	Per cent. of Ash in Coal.	Per cent. of Ash in Coke.	Sulphur in Coke.	Sulphur in Ootl.	Sulphur in Volatile Matter.	Specif. Gravity. Coal.	Specif. Gravity. Gas.
35.1	64.9	2	6	.82	1.48	.66	1.289	.476

MAXIMUM YIELD, 5.06 cubic feet of Gas per pound of Coal—A yield of 4·78 cubic feet per lb.—gave 16 14-100 Candle-Power.

COKE, of very fine quality—1453 pounds produced from one ton of coal.

SALES AGENTS { J. TATNALL LEA, Treasurer, P. O. Box 1747 Philadelphia.
PERKINS & JOB, 27 South Street, N. Y.; 91 State Street, Boston.
H. W. BENEDICT & SON, New Haven.

SCOTCH CANNEL COALS.

THE SUBSCRIBER IS PREPARED TO CONTRACT FOR the supply of all the principal SCOTCH CANNEL COALS. Prices and Analyses of the various Coals will be forwarded on application.

JAMES McKELVIE,
CANNEL COAL MERCHANT,
HAYMARKET, EDINBURGH.
ESTABLISHED 1840. 357-1y

WREN'S GAS WORKS.

W. C. WREN,
Corner of Jay and Water Streets,
BROOKLYN, N. Y.

HAVING GRANTED THE USE OF ONE OF my Patents to the Gas-Light Company o America, and settled my claim against them, I inform the profession that I continue to erect the Works known as

Wren's Gas Works,

and sell Licenses to use my Patents for making Gas from Petroleum.

Gentlemen of the profession:—As your consumers demand a better light, and as that demand has been in many cases sought in vain to be met by using different abortive imitations of my various processes, would it not be well to make success sure by trying the plan of the inventor.

You can enrich your Coal Gas to any desired standard, by using my process, in the simplest manner, and much cheaper than by *any other* method. Address as above. 397

THE NEWBURGH

Orrel Coal Company,

Mines at Newburg, Preston County, W. Va.

Company's Office, No. 52 S. Gay Street, Baltimore, Md.

C. OLIVER O'DONNELL, Pres't. CHAS. MACKALL, Sec'y.

CHAS. W. HAYS, Agent in New York, Room 7, Trinity Building, 111 Broadway.

SINCLAIR & AGNEW, Agents, Alexandria, Va.

This Company offer their very superior Gas Coal at lowest market prices.

It yields 10,996 cubic feet of gas to the ton of 2,240 lbs. of good illuminating power, and of remarkable purity; one bushel of lime purifying 6,792 cubic feet, with a large amount of coke of good quality.

It has been for many years very extensively used by various Gas Companies in the United States, and we beg to refer to the Manhattan, Metropolitan, and New York Gas Light Companies of New York; the Brooklyn and Citizen's Gas Light Companies of Brooklyn, N. Y.; the Baltimore Gas Light Company of Baltimore, Md., and the Providence Gas Light Company, Providence, R. I.

Best dry coals shipped from Locust Point, wharves, and prompt attention given to orders for chartering of vessels.
294-1y n

THE DESPARD COAL COMPANY

OFFER THEIR SUPERIOR

DESPARD COAL

To Gas Light Companies throughout the country.

Agents, PARMELEE BROTHERS, No. 32 Pine street, N. Y.
BANGS & HORTON, No. 31 Duane street, Boston.
Mines in Harrison County, West Virginia.
Wharves Locust Point, Company's Office, 15 German St., } Baltimore.

Among the consumers of Despard Coal, we name: Manhattan Gas Light Company, New York; Metropolitan Gas Light Company, New York; Jersey City Gas Light Company, N. J.; Washington Gas Light Company; Portland Gas Light Company, Maine.

*** Reference to them is requested 304-1y

NEW YORK AND CLEVELAND
GAS COAL COM'Y

Of Pittsburgh, Pa.

MINERS AND SHIPPERS OF

YOUGHIOGHENY GAS COAL.

This Company is prepared to furnish any amount of their justly celebrated, and acknowledged superior GAS COAL, to any point reached by railroad or navigation, on most favorable terms.

General Office—384 Penn Avenue,
PITTSBURGH, PA.
Branch Office—C. & P. RR. Coal Pier,
CLEVELAND, OHIO.

WILLIAM A. McINTOSH, President.
A. CARNEGIE, Vice-President.
W. P. DE ARMIT, Treasurer.
THOMAS AXWORTHY, Agent at Cleveland, Ohio.
W. H. WATERBURY & CO., General Sales Agents,
351-1y 137 Broadway, New York.

PEYTONA
CANNEL COAL

From West Virginia.

Yields over 13,000 feet of Gas per ton. At ten thousand feet (standard yield) the illuminating power is over 43 candles. Purifies 4,510 feet to the bushel of lime.

S. E. LOW, Secretary,
Office, 58 Broadway.

OFFICE OF THE

NATIONAL COAL GAS COMPANY,

No. 4 Warren Street, New York.

H. P. ALLEN, President.
I. B. BRICE, Vice-President.
A. H. ALLEN, Secretary.
WM. J. VALENTINE, Treasurer.
GEORGE W. HARRIS, Engineer.

This Company is the owner of the GWYNNE-HARRIS, or AMERICAN HYDROCARBON process, for making Gas for Lighting or Heating purposes, by the perfect decomposition of superheated steam, under what is known as the

GWYNNE AND HARRIS PATENTS.

This process has been fully tested nearly 50,000,000 cubic feet of Gas having been made under it, and fully demonstrating the fact that it is the greatest improvement ever made in the manufacture of Gas, either for Lighting or Heating purposes. With half a ton of Anthracite Coal 150,000 cubic feet of Gas per day is made from three benches, and the labor is so small that one man can attend three or four benches.

The process can be put into either Coal or Oil Gas Works (or where both Coal and Oil are used) at small cost, without any interruption to the working of other benches. The Citizens Gas-Light Company of Brooklyn, after using it for more than seven months, have found it not only far better, but actually *cheaper* than atmospheric air in making Gas, with the use of "petroleum and its products."

Further information, and terms of sale of rights will be given, upon application to the Company 348-1y

Portland Cement,
Roman Cement,
Keene's White Cement,

English Fire Brick, No. 1, $35 per M.
" Silica Fire Brick, $60 "
FIRE CLAY IMPORTERS.

S. L. MERCHANT & CO.,

76 South Street, New York,
Corner Maiden Lane. 344-1y

☞ Remit 10 cents postage for "Practical Treatise on Cement."

B. E. CHOLLAR,
GAS ENGINEER,

914 OLIVE STREET, ST. LOUIS, MO.

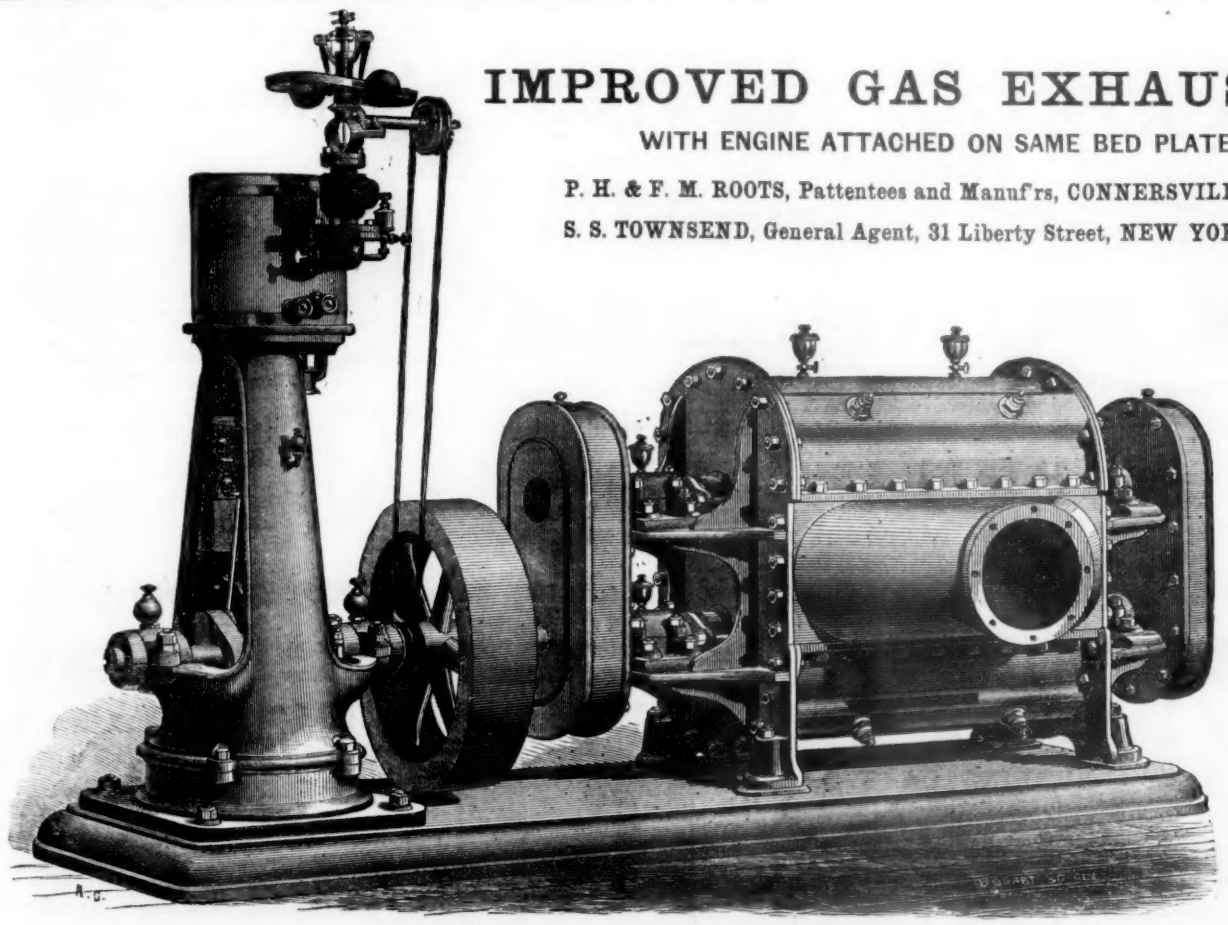
355-

IMPROVED GAS EXHAUSTER,

WITH ENGINE ATTACHED ON SAME BED PLATE.

P. H. & F. M. ROOTS, Pattentees and Manufrs, CONNERSVILLE, IND.

S. S. TOWNSEND, General Agent, 31 Liberty Street, NEW YORK.



ADVANTAGES CLAIMED FOR THIS EXHAUSTER.

1. It is simpler than any other Exhauster. The internal operating parts consist of only two pieces, cast entire, and can not get out of order.
2. Every part requiring care or attention, is external and easily accessible. All changes, adjustments, and repairs are made from the outside.
3. The revolvers, though practically gas-tight, do not run in actual contact, hence there is no friction, and a great saving of power effected.
4. They are built in the most complete and substantial manner, and of any required size, with steel shafts and improved journal bearings.
5. We furnish Exhausters and Engines combined on same Bed Plate, as shown above, or the Exhauster only, as may be required.
6. We also furnish Bye Passes and Gas Valves on improved plans, also Exhauster Governors and Elbows, Pipes, Drawings, etc.

Send for Illustrated Catalogue, giving details of capacity, speed, power required, price, and references to parties using them.

P. H. & F. M. ROOTS.

THE WAVERLY COAL AND COKE CO.

Offer for Sale the

YOUGHIOGHENY COAL

DOUBLE SCREENED,

from their Colliery at Smith's Mills, on the Youghiogheny River, thirty-seven and a half miles southerly of Pittsburgh. This Coal has the preference in Pittsburgh over all other YOUGHIOGHENY COAL for GAS PURPOSES.

The facilities of the WAVERLY COMPANY are unsurpassed by those of any other Company on the Youghiogheny.

Full particulars can be had by addressing

PERKINS & JOB, Agents,
27 South Street, New York.
91 State Street, Boston.

J. H. GAUTIER & CO.,

CORNER OF

GREENE AND ESSEX STREETS,

JERSEY CITY, N. J.

MANUFACTURERS OF

Clay Gas Retorts,
Gas House Tiles,
Fire Bricks, Etc. Etc.
Ground Clay, Fire Brick and Fire Sand in Barrels,

ALWAYS ON HAND.

J. H. GAUTIER.
C. E. GREGORY.

393-1y

CHAS. H. MEYER & CO.,

227 Chestnut Street, Philadelphia, Pa.,

IMPORTERS OF

LAVA TIPS AND SCOTCH TIPS.

ALL ORDERS DELIVERED FREE TO NEW YORK.

359-1y

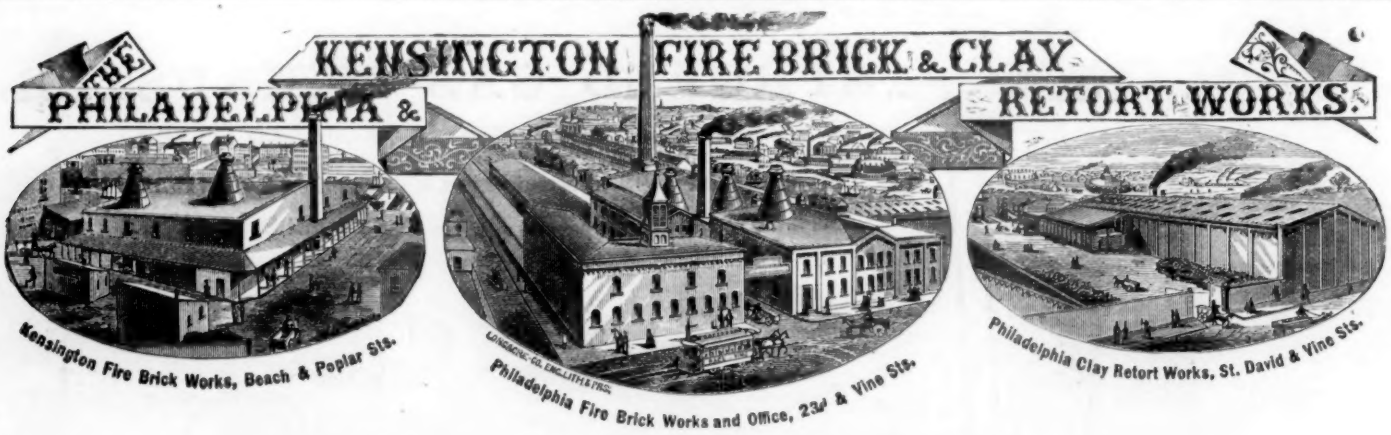
FOR SALE,

200 Tons

CANNEL CHIPS.

Address H. E. HOY,
34 New Street, N. Y.

SPRINGFIELD GAS MACHINE
238 CANAL ST.
NEW YORK


THE PHILADELPHIA &
KENSINGTON FIRE BRICK & CLAY
RETORT WORKS.
Kensington Fire Brick Works, Beach & Poplar Sts.
Philadelphia Fire Brick Works and Office, 23d & Vine Sts.
Philadelphia Clay Retort Works, St. David & Vine Sts.

PHILIP NEUKUMET,

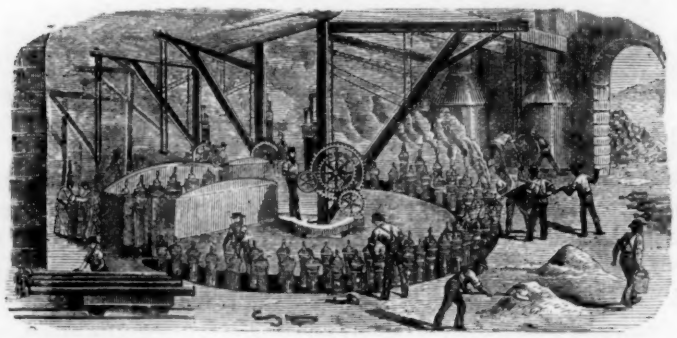
(SUCCESSOR TO JOHN NEUKUMET),

Manufacturer of Fire Bricks, Tiles, Gas and Sugar House Retorts.

☞ Plans of Settings for Benches of Threes, Fives, and Sixes furnished, free of charge, upon application.

M'NEALS & ARCHER,

BURLINGTON. N. J,

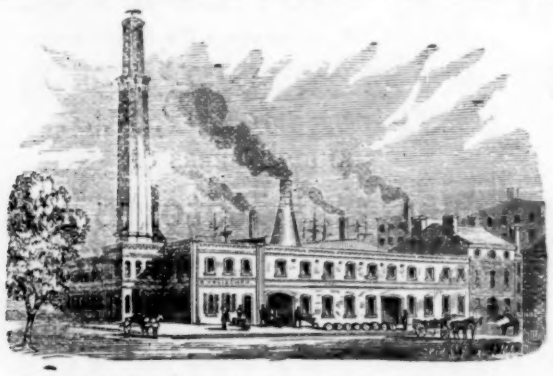


Flange-Pipes

General Foundry Work.

CAST IRON PIPES

FOR WATER AND GAS.



NEW YORK

FIRE BRICK AND CLAY

Retort Works.

☞ *Established in* 1845. ☜

(Branch works at Kreischerville, Staten Island.)

B. KREISCHER & SON,

OFFICE,

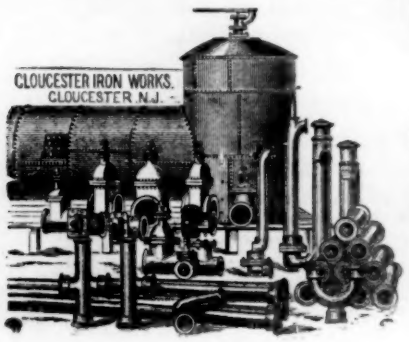
58 Goerck Street, cor. Delancy, N. Y

GAS RETORTS, TILES & FIRE BRICK
Of all shapes and sizes.

FIRE MORTAR, CLAY AND SAND.

Articles of every description made to order at th shortest notice.

B. KREISCHER & SON.



Gloucester Iron Works,

OFFICE—NO. 5 NORTH SEVENTH STREET,

PHILADELPHIA.

DAVID S BROWN, Pres't. JAMES P. MICHELLON Sec'y
BENJAMIN CHEW, Treas. WILLIAM SEXTON Sup't.

CAST IRON GAS AND WATER PIPE.

Cast Iron Heating and Steam Pipe. Stop Valves, water for Gas.

Fire Hydrants,

GAS HOLDERS.

MANHATTAN

FIRE BRICK & ENAMELLED CLAY

RETORT WORKS.

ADAM WEBER,

(Successor to MAURER & WEBER.)

[PROPRIETOR.

Office and Works, 15th Street, Avenue C.

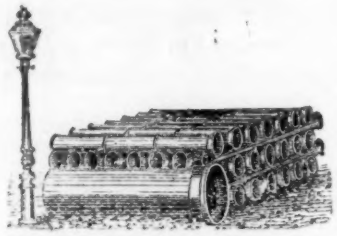
Manufactures of

FIRE BRICK AND TILES,

Of all shapes and sizes.

FIRE MORTAR, CLAY AND SAND.

☞ Articles of every description made to order at short notice. 195



R. D. WOOD & CO.,

PHILADELPHIA.

MANUFACTURERS OF

CAST IRON PIPE

FOR GAS AND WATER

Lamp Posts, Valves, Etc.

Mathew's Pat. Anti-Freezing Hydrants,

400 Chestnut Street.

H. R. SMITH & CO.,

COLUMBUS, OHIO,

MANUFACTURERS OF

CAST IRON GAS & WATER PIPE,

BRANCH CASTINGS, LAMP POSTS, Etc.

(Pipe from three inch and upwards cast *vertically* in 12 feet lengths.)

HEAVY AND LIGHT CASTINGS OF ALL KINDS.

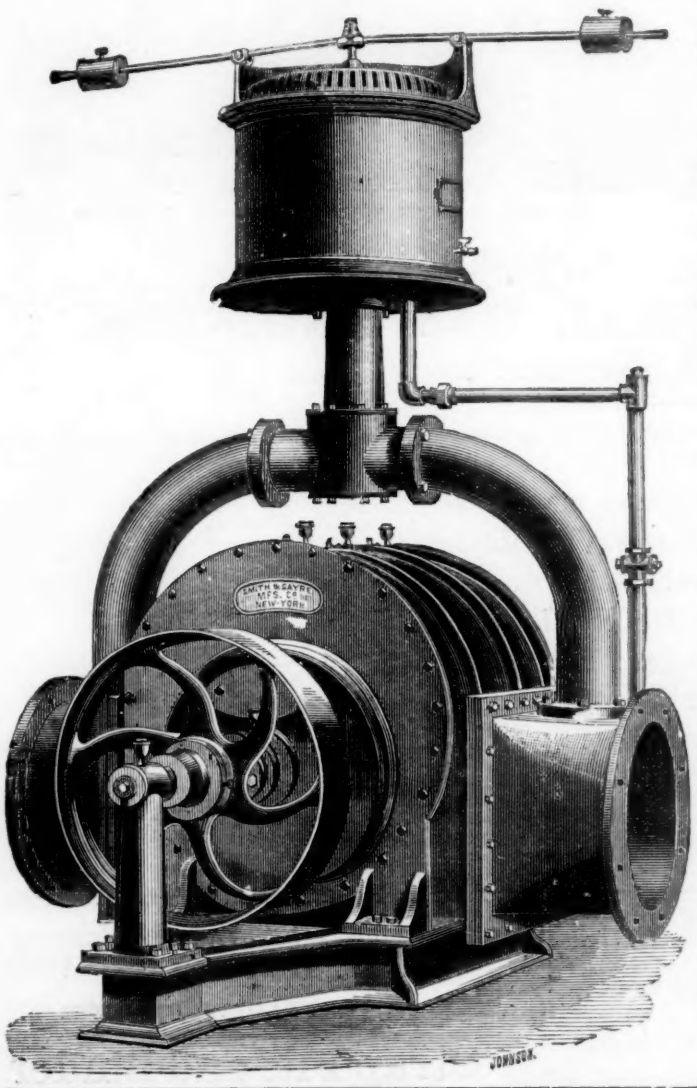
DAILY CAPACITY 125 TONS.

☞ Our Works *connect direct* with *eleven railroads* centering in this city, giving us unequalled facilities for shipping to all points, at the lowest rates of freight. 405-1y

SMITH & SAYRE MANUFACTURING COMPANY.

The Mackenzie Patent Gas Exhauster

And Patent Compensator.



They are made to pass from 4,000 to 150,000 cubic feet of gas per hour; will increase the production and illuminating power of the gas, and add very much to the durability of the retorts, either clay or iron. The Compensator obviates entirely the necessity of water-joints, is compact, durable, cleanly, not liable to get out of order, self-acting, quiet, and certain in its operation.

We are also sole proprietors and manufacturers of the

MACKENZIE PATENT BLOWER, PATENT CUPOLA AND SMELTING FURNACE.

The Blower is a Force Blast machine, durably built, and can be driven with one-third the power required to drive the ordinary fan

The Cupolas are manufactured in sizes to melt from 1 to 20 tons per hour, will save one quarter of the time required by the old style Cupola and 35 per cent fuel. Address

G. G. PORTER, President.

JAMES M. SAYRE, Treasurer.

OFFICE 96 LIBERTY STREET, New York.

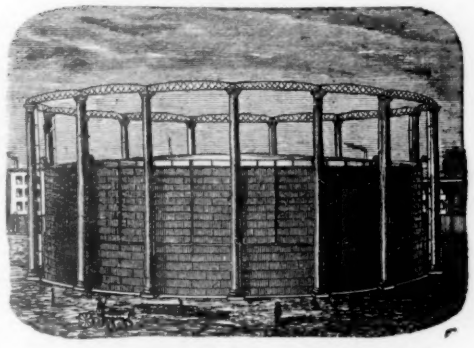
CHARLES W. ISBELL, Secretary.

T. F. ROWLAND,

Continental Works,

GREENPOINT, BROOKLYN, N. Y.

ENGINEER AND MANUFACTURER OF



GAS-HOLDERS

OF ANY MAGNITUDE,

Condensers, Scrubbers, Purifiers, Retorts, Hydraulic Mains and all other articles connected with the Manufacture and Distribution of Gas, furnished with despatch. Plans and Specifications prepared, and Proposals given for the necessary Plans for Lighting Cities, Towns, Mansions, and Manufactories.

JESSE W STARR & SON,

Camden Iron Works

Camden, New Jersey,

Office in Philadelphia No. 435 Chestnut St., where a member of the Firm can be seen between 12 m. and 2 p. m. daily.

MANUFACTURERS OF

ALL KINDS OF CASTINGS AND APPARATUS FOR GAS WORKS,

Wrought Iron Roof Frames,

For Retort and other houses. Retorts and all castings required for setting them in the latest and most improved model. WASHERS, CONDENSERS, SCRUBBERS and EXHAUSTERS for relieving the Retorts from pressure. PURIFIERS, varying from 2,000 to 2,000,000 cubic feet daily purifying capacity.

Wrought Iron Lime Sieves

for Purifiers. Station Meters of all sizes.

GAS HOLDERS,

TELESCOPIC AND SINGLE,

With cast iron guide and suspension frames. GAS GOVERNORS or REGULATORS, STREET MAINS, from 1½ to 48 INCHES DIAMETER, for WATER or GAS. Street Main connections, such as BRANCHES, BENDS, DRIPS, SLEEVES, etc.

STOP VALVES, from 3 to 30 inches, for both Water and Gas.

Wrought Iron Work.

All the Smith and Sheet Iron work required in and about Gas Works. 226-tf

JESSE W. STARR. JESSE W. STARR, JR.

T. DEAN, Pres't. } {H. N. SMITH, Treas.
S. F. DEWEY, V. Pres. } OFFICE OF {CHAS. F. DEAN, Sec.

THE GAS-LIGHT CO. OF AMERICA

Nos. 63 and 64 Drexel Building,

P. O. Box, 5131. NEW YORK.

THE GAS-LIGHT COMPANY OF AMERICA, owners of the Patent Processes for making ILLUMINATING GAS from PETROLEUM and its products, known as the

Gale and Rand

AND

Wren and Barker Patents,

are prepared to treat with Gas Companies and Manufacturers of Gas for the use of said processes.

An examination of the merits of these inventions as demonstrated by practical experience in a large number of Gas Works employing them, will not fail to convince the intelligent Gas Manufacturer of the great advantages derived from their use.

Gas of unexceptional quality, of high illuminating power is made at many of these works by these processes, at a cost of from 40 per cent. to 60 per cent. less than an ordinary quality of illuminating gas can be made by any other methods in use. Gas Companies generally may easily, and at small outlay for making the necessary changes in manufacturing apparatus, double their net earnings, and supply a much better light to their patrons, at greatly reduced prices.

The Company respectfully refer to Companies using these processes in this city, Reading, Penn., Chicago and elsewhere, and especially to the Mutual Gas-Light Company of Detroit, Mich., whose works more nearly conform in all details of construction to the original plans of the inventors than those of other Companies.

For Correspondence, etc., address to office as above.

CHARLES F. DEAN, Secretary.

1842. DEILY & FOWLER. 1876.

LAUREL IRON WORKS.

ADDRESS, 39 LAUREL STREET,

PHILADELPHIA.

MANUFACTURERS OF

GAS HOLDERS,

SINGLE AND TELESCOPIC—WITH CAST OR WROUGHT IRON GUIDE FRAMES.

We are prepared to furnish Holders, Wrought Iron Roof Frames, Bench Castings, Condensers, Scrubbers, Purifiers, Drips, Bends, Tees, and all other Iron Work connected with Gas Works. Previous to 1868 our Mr. D. built *nine Gas Works* and *fifty-four Holders*. Since that date we have built *three Gas Works* and *forty-six Holders*. We *superintend in person* the erection of all our work, and would refer to the Gas Companies at the following places, where we have built Holders, since 1868:

Lancaster, Pa.	Barnesville, O.
Williamsport, Pa.	Franklin, Ind
Bristol, Pa.	Jacksonville, Ill. (2)
Catasaqua, Pa.	Joliet, Ill.
Kittanning, Pa.	Lawrence, Kansas.
Hazelton, Pa.	Jefferson City, N. O., La.
Freeport, Pa.	Algiers, N. O., La.
Huntingdon, Pa.	Kalamazoo, Mich.
Pittston, Pa.	Buffalo, N. Y.
Bethlehem (2), Pa.	Ogdensburg, N. Y.
Sharon, Pa.	Waverly, N. Y.
Canton, Pa.	Little Falls, N. Y.
Annapolis, Md.	Penn Yann, N. Y.
Parkersburg, West Va.	Watkins, N. Y.
Lynchburg, Va.	Gloucester, N. J.
Youngstown, O.	Salem, N. J.
Steubenville, O.	Mount Holly, N. J.
Zanesville, O.	Plainfield, N. J.
Mansfield, O.	Englewood, N. J.
Marion, O.	Dover, Del.
Bellcaire, O.	Pittsfield, Mass.
Athens O.	Meriden Conn.

EVENS & HOWARD,

Manufacturers of a superior qua.'t of

Fire-Brick, Clay Gas Retorts,

Gas Tile, Drain Pipe, Fine Ground Fire Clay, &c.

916 Market Street, St. Louis, Mo.

TYRCONNELL GAS COAL.,

MINED IN TAYLOR COUNTY, WEST VA.

Company's Office, 52 S. Gay St., Baltimore.

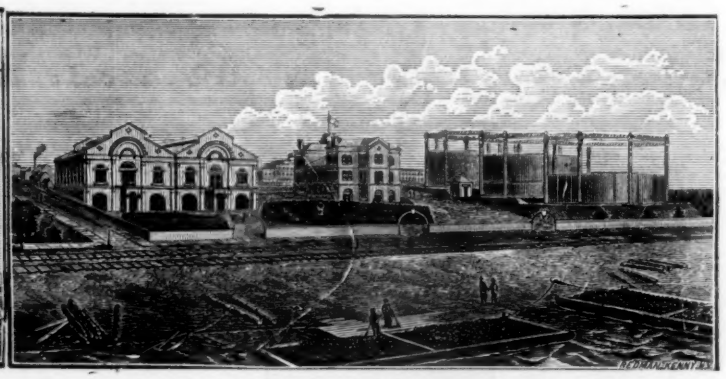
CHARLES MACKALL, Secretary.

CHARLES W. HAYS, Agent, Room 7, 111 B'way, N. Y.

SHIPPING POINT—Baltimore, Md.

This coal yields 10,000 cubic feet of Gas, with an illuminating power of over 16 candles. Forty bushels of very superior Coke, with little scarcely any clinker. 54-1y

CINCINNATI GAS WORKS. ERECTED 1871-72-73.—WM FARMER, ENG.



LACLEDE GAS WORKS, ERECTED 1872.—WM. FARMER, ENG.

WILLIAM FARMER,

ARCHITECT AND GENERAL GAS ENGINEER,

111 BROADWAY, TRINITY BUILDING, Room 95, New York.

WILLIAM FARMER may be consulted upon all matters connected with the construction of GAS WORKS, or any other description of buildings. Will furnish General and Detail Drawings, Specifications and Estimates for Gas Works of any capacity.

PATENTEE OF THE FOLLOWING INVENTIONS:

Exhausters for Gas and Foul Lime Ventilation,
Dumping Barrows for Coal, Coke and Lime,
Hydraulic Mains for Retort Benches,
Blowers for Forges, Foundries, &c.
Pumps for Water, &c., &c.

REFERENCES:

GEN. CHAS. ROOME, President Manhattan Gas-Light Company, N. Y.
A. W. BENSON, President Brooklyn Gas-Light Company, Brooklyn, N. Y.
W. W. SCARBOROUGH, President Cincinnati Gas-Light Company, Cincinnati, Ohio.
S. L. HUSTED, President Laclede Gas-Light Company, St. Louis, Mo.
Professor R. SILLIMAN, New Haven, Conn.
GEN. A. HICKENLOOPER, Vice-President Cincinnati Gas-Light Co., Cincinnati, Ohio
FREDERICK CROMWELL, Vice-President Laclede Gas-Light Company, St. Louis Mo.
C. VANDERVOORT SMITH, Engineer Manhattan Gas-Light Company, N. Y.
JAMES R. SHEDBERG, Consulting Engineer, San Francisco, Cal.
Prof. HENRY WURTZ, 12 Hudson Terrace, Hoboken, N. J.

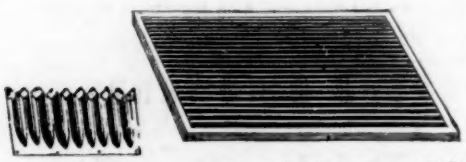
To Gas Companies.

CHEESMAN'S

CONICALLY AND DIAMOND SLOTTED

SOLID WOOD TRAYS.

PATENTED OCTOBER 21, 1862 AND JUNE 10, 1873.



The above Trays are made from half inch to one and a quarter inch thick with a strong centre piece, bars bevelled on top. Also the Diamond Bar Tray can be used either side up smoothest and most durable Trays in use. They are now used by more than three hundred Gas Companies in the United States and other places.

JOHN L. CHEESMAN,
151 and 153 Avenue C, New York.

GEO. W. DRESSER,

CIVIL ENGINEER.

TRINITY BUILDING

ROOM 93. 111 BROADWAY

THE LOWE GAS PROCESS.

S. A. STEVENS & CO,

SOLE AGENTS.

ROOM 87, ASTOR HOUSE.

P. O. Box 1110, NEW YORK.

AND

400 430 WALNUT STREET, PHILADELPHIA.

THE ATTENTION OF

MANUFACTURERS OF COAL GAS

is called to a new Process for Making Gas from the Hydrocarbons distilled from Bituminous Coal at a low temperature and Water Gas, insuring a five-fold increase, and the greatest possible economy and convenience in manufacture.

For particulars see paper on Coal Gas, as published in this Journal March 2nd, 1876, or inquire of

Dr. M. W. KIDDER,
401-12t 47 Indio Street, Boston.

FOR SALE,

A PURIFYING APPARATUS, CONSISTING OF A SIX inch Condenser of 24 columns, 20 feet high, with By-Pass; four Set Washers, 12 inch diameter by 9 feet high, with By-Pass; four round Purifiers 6 feet diameter by 3 feet deep; seven tiers of Trays (cast iron), Covers and Counter Balances, and one 6-inch Dry Centre Valve and Connections.

The above Apparatus is in first rate order, and will be sold cheap. For particulars address

THOS. F. KENDRICK, Sec.
402-4t Nashville Gas-Light Co.

GEORGE H. MORRISON,

Importing Tailor

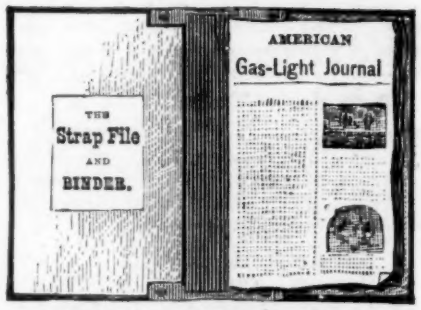
No. 23 East Fifteenth Street,

(Bet. 5th Av'e and Union Square. 97-1y

Keep the Journal for Reference.

HUTCHINSON'S PATENT

Strap File and Binder



ADVANTAGES OF THE STRAP FILE.

1st. It is simple, strong, and easily used.
2nd. Preserves papers without punching holes.
3rd. Will always lie flat open.
4th. Allows any paper on file to be taken off, without disturbing the others.

We will furnish to our subscribers this important article for *preserving in a convenient form*, the numbers of the Journal as it is issued, at the very low price of **$1.25.** Se either by Express or Mail, as directed.

By Mail the postage will be **20** cents, which will be add to the price of the Binder. Send orders to

A. M. CALLENDER & CO.,
42 Pine Street, Room 18 New York.

THE UNITED STATES
HOISTING AND CONVEYING CO.,

OFFICE, 115 BROADWAY, NEW YORK.

ALBERT H. KING, President. MATT. P. WOOD, Engineer.

The MACHINES manufactured and supplied by this Company for HOISTING and CONVEYING COAL, &c., &c., are AUTOMATIC, COMBINING SIMPLICITY, GENERAL UTILITY and GREAT FACILITY IN WORKING. They are NOT LIABLE to GET OUT OF REPAIR.

Weighing Apparatus can be attached, and will weigh without extra cost.

Reference, by permission, is made to the Manhattan Gas-Light Co., at their Works, 18th Street and Nor'h River, N. Y., where the Machines may be seen in daily operation.

LEHIGH AND WILKESBARRE COAL CO., 20th STREET AND E. R., N. Y.
We use your Machine, one man only being required to operate it. It is a decided improvement over any method we have ever seen for Hoisting and Conveying material of any kind.

BLACK DIAMOND STEEL WORKS, PITTSBURGH, PA.
The Hoisting and Conveying Machine suits us. We cannot say too much in its favor.

Working Models of the various Machine may be seen, and full information obtained at the Company's office, Rooms 1, 2, and 3, 115 Broadway, N. Y.

GAS PURIFICATION.

St. John and Cartwright's
NEW IRON COMPOSITION

as purified, per bushel, on a single test, 10,000 feet of Westmoreland Gas. With revivification lasts indefinitely. Surpasses in POWER and ECONOMY all known materials. Saves largely in FIRST COST, SPACE, LABOR, SUPERINTENDENCE, and all current expenses. Will purify *easily* sulphurous gas, wholly *unmanageable by lime.* Takes out *all the ammonia.* Now operating in the following Gas Works: Harlem' New York (21st street); Port Morris; Hunter's Point; East New York Worcester, Lynn and Cambridge, Mass.; Lewiston, Maine; St, Albans, Vt.; Pawtucket, R. I.; Meriden, Ct., and being introduced in many other places.

Cost 70 cents per bushel. One bushel for each square foot of Purifier sufficient. Rights to use for life of Patents, for daily makes of gas in thousands; under 25,000 $200; under 50,000, $400; under 100,000, $500 $250 additional for each additional 50,000 per day.

For further information and instructions, apply to
ST. JOHN & CARTWRIGHT,
21st Street and Avenue A, New York Gas Works.

☞ Immediate arrangements are urged, as the demand for the prepared composition is increasing *so rapidly* that delays in supply may occur.

GEO. STACEY. HENRY RANSHAW WM. STACEY.

GEO. STACEY & CO.,

MANUFACTURERS OF SINGLE AND TELESCOPIC

GAS-HOLDERS,

AND ALL KINDS OF

Cast and Wrought Iron Work

Used in the Erection of Gas and Coal Oil Works.

Foundry on MILL STREET; Nos. 33, 35, 37 and 39.
Office and Wrought Iron Works on RAMSAY STREET Cincinnati, Ohio.

REFERENCE.

Cincinnati Gas-Light Co.	Baton Rouge, La., Gas Co.
Indianopolis Gas Co.	Saginaw, Mich., Gas Co.
Dayton, O., Gaslight Co.	Oshkosh, Wis., Gas Co.
Covington, Ky., Gas Co.	Peoria, Ill., Gas Co.
Springfield, O., Gas Co.	Quincy, Ill., Gas Co.
Terre Haute, Ind., Gas Co.	Champaign, Ills., Gas Co.
Madison, Ind., Gas Co.	Carlinville, Ill., Gas Co.
Kansas City, Mo., Gas Co.	Bowling Green, Ky., Gas Co.
Topeka, Kansas, Gas Co.	Hamilton, Ohio, Gas Co.
Burlington, Iowa, Gas Co.	Vicksburg, Miss., Gas Co.
Nashville, Tenn., Gas Co.	Denver City, Cal., Gas Co.

R. T. Coverdale, Eng'r Cincinnati, and others.

NATIONAL FOUNDRY
AND PIPE WORKS.

OFFICE AND WORKS—CARROLL, PIKE, SMALLMAN AND WILKINS STREETS,
PITTSBURGH, PA

WM. SMITH,

Manufacturer of all kinds of GAS and WATER PIPE BRANCHES, CONNECTIONS, T's, ELBOWS, an all CASTINGS USED AT GAS AND WATER WORKS,

We offer special inducements to parties wishing to purchase. My Pipe is Smooth, regular in weights, and cast vertically.

N. B.—Pipe from 3 inch and upwards, cast in 12-ft. lengths.
☞ SEND FOR CIRCULAR AND PRICE LIST.

MITCHELL, VANCE & CO.,

Manufacturers of

CHANDELIERS!

And Every Description of

GAS FIXTURES,

Also Manufacturers of

fine Gilt Bronze and Marble Clocks, warranted best Timekeepers, Mantle Ornaments, &c.

Salesroom, 597 BROADWAY,

Rear Entrance 140 Mercer Street,) NEW YORK.

Special designs furnished for Gas Fixtures for Churches, Public Halls, Lodges, &c.

S. DECATUR SMITH,

CAST IRON GAS and WATER PIPE,

Foundry, Cor. of York and Moyer Streets,
PHILADELPHIA.

Several Thousand 2, 3, 4, 6 and 8 Inch Cast Iron *Gas and Water Pipes* on hand, for immediate delivery.

☞ FITTINGS FOF GAS AND WATER MAINS. ☜

CAMPBELL, BRICK & CO.,

MANUFACTURERS OF

CAST IRON PIPES,

FOR WATER AND GAS,
Office 112 Leonard Street, N. Y.

ROBERT CAMPBELL.
RILEY A. BRICK.
W. W. CAMPBELL.

Brooklyn Clay Retort
AND
FIRE-BRICK WORKS,

VAN DYKE STREET, BROOKLYN, N. Y.

EDWARD D. WHITE, Surviving Partner of the late firm J. K BRICK & CO. 402-1y

Gas Engineers,

AND PARTIES ENGAGED IN THE BUILDING OF

GAS WORKS,

who desire information regarding PETROLEUM GAS, either for use pure or for enriching, are requested to address, ing particulars.

J. D. PATTON,
363-unl Treverton, Northumberland Co' Pa.

KIDD'S
Gas Consumers' Guide

Enables every Gas Consumer to ascertain at a glance, without any previous knowledge of the Gas Meter, the quantity and money value of the Gas consumed. Also the best method of obtaining from Gas the largest amount of its light.

It will be to the advantage of Gas Companies to supply their Consumers with one of these Guides, as a means of preventing complaints arising from their want of knowledge in regard to the registration of their meters. For sale by

A. M. CALLENDER & Co.,
42 Pine Street, New York, Room 18,

1849. HARRIS, GRIFFIN & CO., 1876.

12th and Brown Streets, Philadelphia, Penna.

and 49 DEY STREET, NEW YORK CITY.

Manufacturers of WET AND DRY GAS METERS, STATION METERS, SHOW AND TEST METERS, METER PROVERS, PRESSURE REGISTERS AND INDICATORS, BAR AND JET PHOTOMETERS, WET AND DRY CENTER VALVES, and all Apparatus pertaining to Gas Works in their line.

Patentee and Sole Manufacturer of the ORIGINAL and ONLY CORRECT GAS EXHAUST GOVERNOR.

We hereby caution all parties against making, vending, or using any GAS EXHAUST GOVERNOR that will be an encroachment of our patent.

The support and confidence of Gas Companies, so long enjoyed by us, encourage us to pursue the same undeviating course that has contributed to establish the character of our house, and with our extended experience and increased facilities, develop the latest improvement that Science can apply, in the construction of Gas Meters, etc., and thereby merit a continuance of the favors hitherto so liberally extended to us, always guaranteeing satisfaction.

ANDREW HARRIS. JOHN J. GRIFFIN.

NOW READY AND FOR SALE,

FODELL'S

System of Bookkeeping

FOR GAS COMPANIES.

Price $5, which should be sent either in Check, P. O. Order, or Registered Letter.

Blank Books, with printed headings and forms on this system, will be supplied to Gas Companies, by applying to W. P. FODELL, Philadelphia, or

A. M. CALLENDER & CO.,
Office GAS-LIGHT JOURNAL, 42 Pine St., N.Y.

McNAB & HARLIN MAN'FG CO.

MANUFACTURERS OF

BRASS COCKS

FOR STEAM, WATER AND GAS.

Plumbers Materials.

WROUGHT IRON PIPE

Gas and Steam Fitters' TOOLS.

56 JOHN STREET, N. Y.

☞ Illustrated Catalogue and Price sent on application,

378-3m

HERRING & FLOYD,

Oregon Iron Foundry

38, 740, 742 and 744 Greenwich St,, N. Y

MANUFACTURERS OF

ALE KINDS OF CASTINGS

AND

APPARATUS FOR GAS-WORKS.

BENCH CASTINGS
from benches of one to six Retorts each.

WASHERS: MULTITUBLAR AND AIR CONDENSERS: CONDENSERS; SCRUBBERS,

and dry), and

EXHAUSTERS
for relieving Retorts from pressure.

BENDS and BRANCHES
of all sizes and description.

FLOYD'S PATENT
MALLEABLE RETORT LID.

SABBATON'S PATENT
FURNACE DOOR AND FRAME.

SELLER'S CEMENT
for stopping leaks in Retorts.

GAS GOVERNORS,

and everything connected with well regulated Gas Works, at low price, and in complete order.

N. B.—STOP VALVES from three to thirty inches—at very low prices.

SILAS C. HERRING. JAMES B. LO .

GRAHAM'S

Patent Anti-Freezing LAMP POST.

THE BEST, CHEAPEST AND MOST DURABLE POST EVER OFFERED TO THE PUBLIC.

WOOSTER, OHIO
Jan. 24, 1871.

J. W. GRAHAM,

Dear Sir: Yours of the 14th inst at hand. In reply I would say that we have tested the six anti-freezing Lamp Posts purchased from you, and find them to be all as you represented. Whilst nearly a dozen of our sixty-five Posts were frozen down last month and first of this not one of yours was affected by the heavy frost. What can you sell them at?

Yours truly,
LUCAS FLATTERY
Sec'y Wooster Gas-Light Co.

Address the Patentee,

J. W. GRAHAM,
Chillicothe, Ohio.

259-9t

LUDLOW

Valve Manf'g Co.,

OFFICE AND WORKS

938 to 954 River Street and 67 to 83 Vail Ave

TROY, NEW YORK.

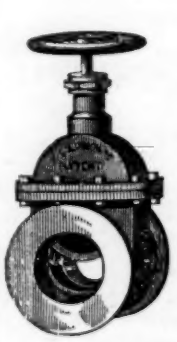
BRASS AND IRON SLIDE VALVES.

(Double and Single Gate ¾ inch to 36 inch—outside and inside screws, Indicator etc.) for Gas, Water and Steam—

HYDRAULIC MAIN DIP REGULATORS.

ALSO

FIRE HYDRANTS.



REFEENCES FURNISHED.

SEND FOR CIRCULARS.

NEW YORK SHOVEL WORKS.

MANUFACTURERS OF

SHOVELS, SCOOPS & SPADES.

SHOVELS AND SCOOPS A SPECIALTY

For Gas-Light Companies.

DEAN'S PATENT

COKE SCREENING SCOOPS.

Frames are 12 by 18 inch, seven bars, best Malleable Iron. They can be mad to screen any size desired.

A. SEE & SON,
404-1y 1358 Broadway, N. Y.

REMOVAL.

BUTLER'S PATENT Coke and Coal

SCREENING SHOVELS

MADE FROM BEST MALLEABLE IRON AND STEEL.

FURNISHED WITH LONG OR D HANDLES

Perfect in their operation, is very strong, and from their great durability vastly more economical than any substitute. Refer to all the principal gas Companies in the country, who acknowledge them as the "ne plus ultra of Coke Screening Shovels.

Ordersaddressed only to

HERRING & FLOYD,
Sole Agents,
740 Greenwich St., N. Y.

☞ I still retain the original SABBATON LETTERS PATENT, and have granted no rights or privileges to any other parties.

Prof. Henry Wurtz,

Chemist and Geologist.

Offers his professional services, in the field and the laboratory, in the investigation, by the most recent and advanced scientific methods, of all questions of Water supply of towns dwellings, factories, steam-boilers, etc. Chemical Analyses of River; Lake, Spring and Well-Waters, made by the most improved methods.

Prof. W. makes a speciaity of GAS CHEMISTRY, and the Analysis of Gas, Gas and other Coals, and Potable Waters. Has special laboratories and unequalled facilities for these purposes. Formerly Chemical Examiner in the U. S Patent Office, and peculiarly competent.

SAMUEL DOWN, President. WM. H. HOPPER, Vice-Pres't. WM. N. MILSTED, Sec. and Treas. T. C. HOPPER, Gen'l Sup't.

AMERICAN METER COMPANY,

MANUFACTURERS OF

Wet and Dry Gas Meters (with Slide or Rotary Valves), Station Meters, Dry Centre Valves, Pressure Registers, Pressure and Vacuum Registers, Meter Provers, King's Pressure and Vacuum Gauges, Exhauster Governors, Experimental Meters, Watchman's Clocks, Etc., Etc.

☞ Sole Agents for W. Sugg's **PHOTOMETRICAL** and **ANALYTICAL GAS APPARATUS.**

A full assortment of the above kept at the Manufactories and Agencies, where orders may be addressed,

Agencies.

37 Water Street, Cincinnati.
20 South Canal Street, Chicago.
511 Olivo Street, St. Louis.

American Meter Compauy,

512 West Twenty-sceond Street, New York.
Arch and Twenty-second Street, Philadelphia.
548 Washington Street, Boston.

HARRIS, HELME & McILHENNY,

Successors to Harris & Brother.

ESTABLISHED 1848.

PRACTICAL GAS METER MANUFACTURERS,

Continue as heretofore at the OLD ESTABLISHMENT, Nos. 1115 and 1117 Cherry Street, Philadelphia, Pa.,

To manufacture Wet and Dry Gas Meters, Station Meters, Experimental Meters, Meter Provers, Centre Seals, Governors, Pressure Registers, Indicators, Photometers, and all kinds of Gas Apparatus; Also furnish all other Articles appertaining to the use of Gas Works.

From our long Practical Experience of the Business (covering a period of 28 years) and from our personal supervision of all Work, we can guarantee all orders to be executed promptly, and in every respect satisfactorily.

WASHINGTON HARRIS. WILLIAM HELME. JOHN McILHENNY.

WILLIAM W. GOODWIN & CO.

No. 1012, 1014 and 1016 Filbert Street,

Philadelphia, Penn'a.

MANUFACTURERS OF

Dry and Wet GAS METERS, Station Meters (Square, Cylindrical or in Staves), Glazed Meters, King's and Sugg's Experimental Meters, Lamp Post Meters, Etc., Etc., Meter Provers (sizes 2, 5 and 10 feet), Pressure Guages of all kinds, Pressure Registers, Pressure and Vacuum Registers, Pressure Indicators (sizes 4 inch, 6 inch and 9 inch), King's Pressure and Vacuum Gauges, Dry and Wet Centre Seals, Dry and Wet Governors, Exhauster Governors, Photometers of all descriptions. Letheby's Sulphur and Ammonia Test Apparatus complete—also Testing and Chemical Apparatus of all kinds, and of the most perfect description, for all purposes relating to Gas.

Goodwin's Improved Lowe's Jet Photometer.

W. W. Goodwin is the author of the History and Principles involved in the use of Lowe's Jet Photometer. Also Patentee and we are the SOLE MANUFACTURERS of the ORIGINAL and ONLY DIAL whereby the CANDLE POWER and PRESSURE can be instantly read, and all others are infringements.

Special attention to repairs of Meters, and all apparatus connected with the business.

All work guaranteed first class in every particular, and orders filled promptly.

WILLIAM WALLACE GOODWIN. [335 1y] HOWARD KIRK, Special Partner.

CENTENNIAL DRAWINGS.

Prospective or Geometrical Drawings of Buildings and Apparatus, suitable for Exhibition Purposes. Finest work. Address

F. H. MULLER.
126 East 52nd Street, N. Y.

GARDNER BROTHERS,

MANUFACTURERS OF

Clay Gas Retorts, Retort Settings, Fire Bricks, Etc.

Works, Lockport, Westmoreland Co., Pa.)
Office, 96½ Fourth Avenue,
PITTSBURGH, PA.

J. R. SCOTT,
en'l Agent for New England,
Washington St., Boston.

MURRAY & BAKER,

Practical Builders,

And Contractors for the Erection of Gas Works,

MANUFACTURERS OF ALL THE LATEST AND MOST IMPROVED APPARATUS AND TOOLS FOR THE MANUFACTURE & DISTRIBUTION OF COAL GAS.

☞ WORKS AT THE RAILWAY DEPOTS,

FORT WAYNE, INDIANA.

We manufacture Bench Castings, Washers, "The Immersed Multitubular," and Atmospheric Condensers, Wet and Dry-Lime Purifiers, Dry Center Seals, Telescopic and Single Gas Holders, Wrought Iron Trussed Roof for Iron or Slate, Wood and Iron Trays for Purifiers, Coke and Coal Carts, Wrought Iron Screening Shovels and Castings, and Wrought Work of every description for Gas-Works.

As Mr. Murray is a Practical Draughtsman, we will furnish plans and specifications to parties or associations, or will wait personally upon parties contemplating the construction of new works, or the alteration or extension of old ones

The most satisfactory references can be given, if required of the experience and commercial fairness which characterizes our dealings.

We would respectfully invite Western men to call and see our patterns and works here. MURRAY & BAKER, Fort Wayne, Indiana.

B. S, BENSON.

MANUFACTURER OF

Cast Iron Pipes and Fittings,

AND

Gas and Water Mains.

All sizes from 3 to 30 inch cast vertically in 12½ feet lengths

[Office & Factory 52 East Monument St.,
BALTIMORE, MD.

C. GEFRORER,

Manufacturer of

GAS BURNERS,

GAS HEATING AND COOKING APPARATUS.

GAS FITTERS' PROVING APPARATUS. ETC.,

No. 248 North Eighth Street, Philadelphia.

MORRIS, TASKER & CO., Limited.

PASCAL IRON WORKS, PHIL'A.

DELAWARE IRON CO., NEWCASTLE, DEL.

OFFICE, NO. 209 SOUTH THIRD STREET, PHILADELPHIA.

Office and Warehouse, 15 Gold Street, New York.

Office and Warehouse, 36 Oliver Street, Boston, Mass.

FOR GAS WORKS MACHINERY, ADDRESS OFFICE, 209 SOUTH THIRD STREET, PHILADELPHIA.

Manufacturers and Builders of Gas Works, of all Descriptions, of the latest improved Plans.

WROUGHT IRON ROOF FRAMES.—For Slate, or Corrugated Iron Coverings, with Cast Iron Cornice Gutter. Iron Doors and Frames, Wrought Iron Pivot Blinds, Windows and all kinds of Castings and Smith Work for Buildings.

BENCH CASTINGS.—Retorts, and all Castings and Wrought Iron Work required for Setting them on the Latest Plan. Tar Gates, Wrought Iron Stand Pipes, Retort Lids, Cotter Bars, Coal and Coke Wagons and Stokers' Tools.

EXHAUSTERS.—Exhausters and Compensators, By-Passes to pass from 4,000 to 150,000 cubic feet of Gas per hour, with Engines, Governors, Pressure and Vacuum Gauges.

SCRUBBERS.—Single or Multitubular Scrubbers, with Self-Acting Pumps for Ammonia Water.

WASHERS.—Cataract and Single and Multitubular Spray Washers.

CONDENSERS.—Single and Multitubular Air and Water Condensers.

PURIFIERS.—For Purifying from 1,000 to 2,000,000 cubic feet capacity daily, with either wet or dry Lime, or Oxide of Iron, and with either Ash Rivetted or Wrought or Cast Iron Lime Sieves.

CARRIAGES.—Movable Lifting Carriages for Purifiers, arranged either for Floor or Overhead use.

METERS.—Square and Round Meters of any capacity.

GAS HOLDERS.—Single Lift and Telescopic Gasholders, with Cast or Wrought Iron Suspension Frames.

GAS GOVERNORS.—Station Governors, with Regulating and Indicating Columns for Inlet and Outlet Pipes, also Dry Governors with Flexible Diaphragms for Underground Pipes.

STOP VALVES.—Double Faced Stop Valves for Gas or Water, from three inches to forty-eight inches diameter. These Valves are proved on both sides, with a heavy Water Pressure, Flange and Bell Pipes, Fittings and Drips of all descriptions. Steam Boilers and Hot Water Apparatus for Heating, Building, and Gas Holder Tanks. Lamp Posts and Lanterns.

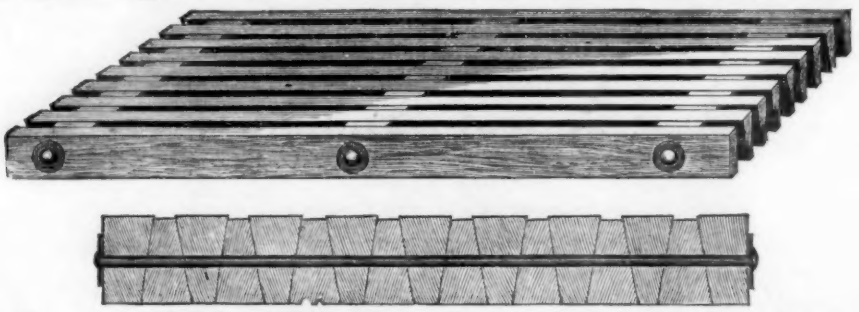
Sole agents and manufacturers of Morton and Holman's,and Munzinger's **Patent Self-Sealing Retort Lids.**

Manufacturers of **Wrought Iron Welded Tubes,** Plain, Galvanized and Rubber Coated, for Gas, Steam, and Water.

Lap-welded Charcoal Iron **Boiler Tubes.**

Oil Well Casing and Tubing. Gas and Steam Fittings. Improved Sugar Machinery.

P. Munzinger's Patent Ash Lime Trays.



In use at the following Gas-Light Companies:

Pittsburg Gas Company, Pa.
Peoples Gas Company, Baltimore.
Lowell Gas-Light Company, Mass.
Lynn Gas-Light Company, Mass.
Albany Gas-Light Company, N. Y.
Schenectady Gas Light Company, N. Y.
Utica Gas-Light Company, N. Y.
Jersey City Gas Company, N. J.
St. Paul Gas-Light Company, Minn.
Cumberland Gas-Light Company, Md.
Hartford City Gas-Light Company, Conn.
Richmond Gas Company, Va.
McKeesport Gas Company, Pa.
Middletown Gas Company, Pa.
East Newark Gas-Light Company, N. J.
Binghampton Gas Company, N. Y.
Zanesville Gas Company, Ohio.

New Orleans Gas Company, La.
Salem Gas-Light Company, Mass.
New Britain Gas-Light Company, Conn.
Rahway Gas-Light Company, N. J.
Trenton Gas-Light Company, N. J.
Elmira Gas Company, New York.
Erie Gas Company, Pa.
Columbus Gas-Light Company, Ohio,
Westchester Gas-Light Company, N. Y.
Santa Cruz Gas Company, Cal.
Lawrence Gas-Light Company, Kansas
Salem Gas Company, N. J.
Indiana Gas-Light Company, Pa.
Peoria Gas Company, Ill.
Montclair Gas Company, N. J.
Williamsport Gas Company, Pa.
Wooster Gas Light Company, Ohio.

Augusta Gas-Light Company, Ga.
Huntsville Gas Company, Ga.
Chattanooga Gas Company Tenn.
Murfreesboro Gas Company, Tenn.
Hagerstown Gas-Light Company, Md.
Hanover Gas Company, Pa.
Easton Gas Company, Pa.
Uniontown Gas-Light Company, Pa.
Coatesville Gas-Light Company, Pa.
Houston, Gas Company, Texas.
Wilkesbarre Gas Company, La.
Middletown Gas Company, New York
Washington Gas-Light Company, Pa.
Princeton Gas-Light Company, N. J.
Newark Gas Company, Ohio.
Pontiac Gas-Light Company, Mich.
And numerous other Companies.